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EDITORIAL.

The Rice Situation.

Circumstances are causing attention to be focussed more and more on the economic questions underlying agricultural production in the tropics. Probably at no single time has there been a concatenation of low prices in so many tropical products as at the present day. Rubber, copra, tea, coffee and sugar, to enumerate certain of them, are all suffering from depressed market conditions, and this depression is due in every case to the same cause, namely, disability to regulate the production of these staples in accordance with the demand. The world is really only commencing to realise the vast potential producing power of the tropics, and the measure to which it is capable of being increased by the systematic application of scientific knowledge to production.

Coupled with this increasing production is a rapidly increasing population, and to meet the needs of this population there must be an equally rapidly increasing food supply; this in turn directs attention to the rice situation, which, at any rate in the Eastern Tropics, is the key to the economic position.

In Malaya and Ceylon, the tendency is markedly to develop an export trade in other staples and to trust to importation of food stuffs to supply the needs of the population.

In Java, on the other hand, as also in the Philippines and Japan, the Governments have placed the development of a domestic food supply in the forefront of policy, and as a result, the rice supply has steadily augmented in these countries; notwithstanding this, the demands of the increasing population have, in Japan at least, caused that country to be converted of recent years, from an exporting into an importing unit.

The view officially held in these countries is well expressed in Copeland's well-known book on Rice in the following terms:—"The economic condition which results from the supplanting of rice by export crops of other kinds is decidedly unsafe. Let the market for the export crop fail, and the resulting condition is at once worse than the prevalent oriental poverty. Government in Java, Japan, and the Philippines has therefore done well in giving its keenest attention to stimulating the production of rice. The market may slump as it will, where rice itself is the export crop, without serious consequent suffering. But where other crops must furnish the money to buy foreign rice, hunger may enter promptly when rubber, tobacco, coffee and tea, and copra cannot be sold."

In a document presented to the recent Pacific Science Congress, Dr. M. B. Smits, Acting Chief of the Division of Agricultural Economics of the N.E.I., Department of Agriculture has reviewed the rice situation of the world. In this review he shows that for rice import the world is principally dependent on three countries, viz., British India including Burma, Siam and Indo China, of which, on the average, the production of British India is about equal to the other two, giving a gross potential production for all these of approximately 4,000,000 tons per annum. The quantity of rice available in these countries for export does not show a marked tendency to increase, and data do not warrant the expectation that any increase will occur. In the presence of such a condition of affairs and with low markets for other export products, a failure of the rice crop in these exporting countries may well create a condition of serious crisis throughout rice importing countries. Under such conditions, particular interest therefore centres at present in all matters relating to the domestic rice production of Malaya, and in this connection particular attention may be directed to an article appearing elsewhere in this issue in which the rice position in Malaya is reviewed.

Colombian Pita Fibre.

A prospectus has recently come to hand announcing the formation in London of a company to be known as Fibre Products (Pita) Limited, with the object of exploiting Pita fibre in the Republic of Colombia, South America.

It is generally known that the cultivation of the Colombian Pita plant (*Bromelia Magdalenae* Wright) was attempted in the Federated Malay States some seven years ago under the name of Arghan Fibre. The failure of the Arghan Company was due, as far as can be ascertained, to lack of suitable decorticating machinery and eventual exhaustion of the company's capital. A description of this fibre plant and its uses was published in the Malayan Agricultural Journal, Vol. XII (1924) page 185.

The present company proposes to acquire a large tract of land at Las Tangas in Colombia, containing indigenous Pita plants. From the prospectus it appears that the plants occur wild in considerable abundance. It is estimated that on one portion of the estate alone, comprising an area of 2,750 acres, a minimum yield of 1,500 tons of fibre per annum may be obtained at the present time without undue cutting. It is also proposed to extend the area under Pita by planting, so as to produce a further 1,500 tons of fibre per annum.

The fibre is stated to be suitable for use in the manufacture of fine strong twine and high-grade paper.

This appears to be the third attempt to exploit Pita fibre. The present company proposes to produce 300 tons of fibre during the first working year. A specially constructed decorticating machine is stated to be in use with satisfactory results.

Colombian Pita grows luxuriantly under suitable conditions in Malaya.

The results, therefore, of the new venture in South America will be watched with considerable interest here.

School of Agriculture, Malaya.

Under the above heading, this issue contains an article by Mr. G. E. Mann, Agricultural Instructor in the Department of Agriculture, giving some account of the projected organisation of the Malayan School of Agriculture which it is anticipated will be ready for opening in 1931. The article in question indicates the various steps which led to the inception of the proposals and also outlines the syllabus of instruction. Of recent years, increasing attention has become directed to the question of agricultural education, and it is now recognised universally that some such provision is necessary. In Malaya, hitherto the facilities for agricultural education have been strictly limited. The inauguration of the school will mark a decided step in advance, which should go some distance towards bringing Malaya into line with adjacent countries, e.g., Ceylon and Java, where progress in the same direction has been much more marked.

It should, however, be noted that agricultural education cannot be regarded as beginning or ending with the provision of one single institution for the instruction of students. The requirements of different sections of the community should be taken into consideration and the attempt made to obtain a picture of agricultural education as a whole rather than as a series of separate parts. Particularly is this the case in the relationships which obtain between elementary and more advanced agricultural education. A prominent and particularly satisfactory feature of education in Malaya is the marked agricultural bias which has of late years been given to elementary education in Malay Vernacular Schools, due primarily to the work of the Sultan Idris Training College at Tanjong Malim. Elementary rural science and school gardening is now taught in the majority of the Malay Vernacular Schools throughout the Peninsula and this should be regarded as the first step in a general system of agricultural education which will, it is hoped, ultimately arise, and which will comprise farm schools providing for the further instruction in agriculture of past pupils of elementary schools together with a central agricultural school, which provides for higher training in agriculture of pupils who have already attained the standard required in the higher classes of the English schools.

On the degree of knowledge of agriculture possessed by its inhabitants the future of an agricultural country in large part depends, hence these efforts towards establishing a system of agricultural education in Malaya based on experience obtained in many other countries, have considerable permanent interest.

ORIGINAL ARTICLES.

TEA EXPERIMENTS.

BY

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Introductory.

A memorandum on the work conducted by the Department of Agriculture with the experimental cultivation of tea was prepared for a special meeting of the Advisory Committee held on the 28th November, 1928. This memorandum was published in the Malayan Agricultural Journal, Vol. XVII, No. 1 (January, 1929). It is now proposed to record the work undertaken during the year 1929 at the Government Plantations at Serdang in Selangor, and Cameron's Highlands in Pahang.

Experiments at the Government Plantation, Serdang.

The areas under tea at Serdang represent average conditions on the plains in Selangor, the soil consisting of a friable clay loam, with occasional outcrops of "laterite," derived from parent quartzitic rock.

Mature Tea Area.

This area comprises one-acre plots of four varieties of Assam and Manipuri jats and a one-acre plot of the local Chinese variety. Of the former, Dangri seed was sown on the 16th December, 1924, and Dhonjan, Betjan and Rajghur seed was sown on the 18th January, 1925. All seed were germinated in boxes and the newly-germinated seedlings planted direct in the field at a distance of 4 feet by 4 feet, giving 2,722 plants per acre.

The plants were all pruned back to within about 9 inches from the ground in October, 1926. The bushes were again pruned in October, 1927, to within 3 inches of the previous cut. The tea plants were again heavily pruned during August, 1928. On the 12th October, 1928, a regular seven-day round of plucking was commenced and the yields of fresh leaf have been recorded since that date.

The following table records the actual weights of fresh leaf harvested during the first year of plucking. It should be noted that no comparisons may be made between the totals of the fresh leaf for the year owing to variations of the numbers of bushes in each plot. All vacancies have now been supplied, but it was not possible to do this previously owing to lack of seed of the particular jats.

Assam Tea, 5 years old, at the Government Plantation, Serdang.

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TABLE I.

Monthly Yield of Tea Leaf from 12th October, 1928 to 11th October, 1929.

Month.	Dangri.	Dhonjan.	Rajghur.	Betjan.
	lbs.	lbs.	lbs.	lbs.
October (part) -	117	85	28	40
November -	210	37	72	46
December -	182	236	195	154
January -	191	147	123	109
February -	190	147	130	84
March -	175	129	158	119
April -	113	121	59	43
May -	197	210	145	298
June -	288	248	241	208
July -	307	293	199	303
August -	188	165	148	161
September -	239	201	242	255
October (part) -	55	60	52	50
Totals	2,452	2,079	1,792	1,870

In the following table the actual yields of leaf and the calculated yields of made tea from the respective plots, on a basis of 1 lb. tea to 4 lbs. green leaf, are shown together with the number of bushes plucked in each plot.

It is to be noted that the calculated yields of tea shown in the last column are those from the actual bushes in cropping only. In the case of Betjan only half the possible number of bushes per acre were plucked.

Yields from the one-acre plot of Chinese tea are not recorded, as this area, being on the steepest part of the land, suffered considerably from soil erosion, which resulted in a large number of the bushes dying. This plot was supplied with seedlings during April of this year.

TABLE II.

Yields of Leaf and Calculated Yields of Tea from 12th October, 1928 to 11th October, 1929.

Jat.	No. of bushes plucked.	Percentage actual to possible bushes.	Actual Weight of leaf plucked.	Calculated yeild of tea per plot.
			lbs.	lbs.
Dangri -	2,249	.826 per cent.	2,452	613
Dhonjan -	1,749	.644 ,,	2,079	520
Rajghur -	2,198	.807 ,,	1,792	448
Betjan -	1,313	.497 ,,	1,870	467

Soil Conservation.—The original silt pits, dug 4 ft. × 1 ft. × 1 ft. between alternate rows of the bushes, have proved to be unsatisfactory and were replaced by a system of deep contour silt pits during August, 1929. Provided these pits are periodically cleaned out, it is considered that adequate protection against soil erosion is now afforded.

Shade.—Young trees of *Albizzia moluccana* were planted throughout the area at a distance of 32 feet by 32 feet, square planting. These trees were planted during April and have made rapid growth. Additional trees of *Grevillea robusta* and *Gliricidia maculata* were established as wind breaks and green manures respectively during April and May.

Cover Crop.—Several cover crops have been tried and discarded in favour of *Indigofera endecaphylla* which is fairly satisfactory, though subject to the attacks of insect pests. Every effort is now being made to encourage the growth of this legume throughout the entire area.

Immature Tea Areas.

The following jats of tea seed were received during the year 1929:—Dangri 4 maunds, Dhonjan ½ maund, Rajghur ½ maund, Betjan ½ maund (January); Kirrimittia 5 maunds, Bogantalawa 25 lbs., (March); Mahawella ¼ maund (August).

The last three consignments, namely those from Kirrimittia, Bogantalawa, and Mahawella, were obtained from Ceylon.

Block 16 (Area 9.12 acres).

This block was previously under pineapples. Owing to the configuration of the land little damage has occurred from soil erosion, though naturally the

soil is not as fertile as virgin land. Prior to planting the tea seedlings, a system of deep contour silt pits was undertaken. This system has proved satisfactory and little soil wash occurs, though heavy rains were experienced during October and November.

Planting.—This area was planted with four months' old Dangri seedlings during the month of May, 1929. The following planting distances were undertaken:—4 ft. by 4 ft. 3 acres, 4 ft. by 3½ ft. 3 acres, 4 ft. by 3 ft. 3 acres.

Although dry weather set in shortly after planting, the seedlings have made good growth. A number of vacancies occurred and these were supplied during October. There is little doubt, however, that the most satisfactory results are to be obtained by planting during the months of October, November, and December, when the rainfall is heaviest and planting conditions may be considered ideal.

Shade.—Seedlings of *Albizzia moluccana* were planted throughout the block at a distance of 32 feet by 32 feet. *Grevillea robusta* has been established on the two exposed sides of the block as wind belts.

Block 15 (Area 10½ acres.)

This area, which was formerly under fodder grasses, was cleaned up in September, 1929, in preparation for planting seedlings of Kirrimittia, Bogantalawa and Mahawella jats received from Ceylon.

The following planting programme was undertaken during November: Kirrimittia 8 acres, various planting distances from 4 ft. by 4 ft. to 3½ ft. by 3 ft., Bogantalawa ½ acre, Mahawella ¼ acre.

A variety of shade trees are being raised in the nursery and these, when of sufficient size, will be planted throughout the area.

The entire block being comparatively flat, no soil conservation has so far been undertaken but drains, where necessary, have been put in. It is considered, however, that some system of silt pits will be necessary and this matter is receiving attention.

Machinery.

The following tea machinery has been installed at the Government Plantation, Serdang:—

1 "Little Giant" Tea Roller (capacity 60 lbs. withered leaf per charge).
1 Roll Breaker, 9 feet long.
1 Tea Cutter, fitted with 3/8 inch cells.

In addition to the above, a set of hand sieves is employed for grading the fired leaf.

A temporary withering room has been constructed with about 1,000 square feet of "tats" available for withering the crop of green leaf. This accommo-

dation is insufficient for the present requirements and a proportion of the leaf harvested has to be withered on cement floors.

A "chula" drier is used for firing the rolled leaf with only partially satisfactory results.

Provision has been approved by Government in the 1930 Estimates for the erection of an experimental tea factory and purchase of necessary machinery to supplement that already in use.

REPORTS ON TEA SAMPLES GROWN AND PREPARED AT THE GOVERNMENT PLANTATION, SERDANG :—

A sample of tea produced from the 4 year—old bushes at Serdang, was submitted to Messrs. Keell & Waldock, Colombo, who forwarded the following report and valuation, dated 18th April, 1929, on the sample in question.

Grade.	Colombo Value Rs.	London Equivalent Rs.	Remarks.
B. O. Pekoe	1/05-1/10	Nom.	Black, well-twisted, rather bold, irregular leaf, good appearance, fair show of bright golden tip.

Liquor—Fair strength and colour, rather plain, common.
Infused leaf not bright enough, too mixed and irregular.
Liquor is dull and coarse and has been fired at too high a temperature.
The valuation is a nominal one on account of the good show of tip and appearance of the leaf. Without the tip the tea would be worth about -/62 cents.

A further sample forwarded to the Malayan Information Agency, London, was submitted to Messrs. Gow, Wilson & Stanton Ltd., who furnished the following report :—

> "*Dry Leaf.* Blackish brownish, rather uneven broken, containing a good lot of small tea with just a few tips.
> *Firing.* The tea has been heavily overfired.
> *Liquor.* Whilst possessing some colour, tastes coarse and "bakey".
> *Infused Leaf.* Dark and mixed, showing overfiring.

With reference to your letters of the 3rd and 5th April:

(1) Dry leaf is fairly satisfactory in appearance, but we should like to see it free from the small tea running through it.
(2) Presumably the tea has been hand-rolled and under these circumstances it is fairly satisfactory.
(3) The tea has been heavily overfired, bringing about a coarse and "bakey" character on the liquor.

Seeing that this tea has been produced at an elevation of 200 feet we are of opinion that when manufacture is carried out under proper conditions, it would compare very favourably with Sumatra and Java growths."

It will be seen from these reports that the samples were over-fired and with the present "chula" drier it is a matter of considerable difficulty to remedy this defect. It is anticipated, however, that with the addition of more suitable means of manufacture and the use of a proper drying machine in particular, it will be possible to produce tea of considerably better quality in the near future.

Experiments at the Government Plantation, Cameron's Highlands, Pahang.

The Government Plantation at Tanah Rata is situated at the extreme south-east corner of the Highlands area, at an elevation of about 4,750 feet.

Mature Tea Area.

This consists of a small number of bushes, raised from seed during January, 1925, of the following jats:—Betjan, Dhonjan, and Rajghur. The plants are spaced 4 feet by 4 feet apart and have made very vigorous growth. Plucking commenced on the 24th July, 1927, i.e., about $2\frac{1}{2}$ years from sowing the seed. The bushes have been cropped regularly at intervals of 9 to 10 days.

The following are the calculated yields of dry tea per acre from this area, taking the size of these plots as 1/6th of an acre:—

First plucking year ending 23rd July, 1928—470 lbs. per acre.
Second plucking year ending 23rd July, 1929—525 lbs. per acre.

Owing to the present inaccessibility of the Plantation, it has not been possible to instal any machinery. Further, the "chula" drier employed is of very primitive construction resulting in frequent occurrences of over-firing of the leaf.

Report on a sample of tea grown and prepared at the Government Plantation, Cameron's Highlands:—

Samples of tea obtained from 4 years-old bushes growing at Tanah Rata and manufactured by hand on the Highlands were handed to Messrs. Guthrie & Co., Ltd. Kuala Lumpur, who forwarded them to their London Office for report and valuation.

The following reports were received from (1) Messrs Chas. Hope & Son, and (2) Messrs Lloyd, Matheson & Carritt, dated 5th October, 1929:—

(1) "*Leaf.*—This tea has the appearance of a leaf well-graded Bro-Or-Pekoe with a fair show of good coloured tip and does not contain any very coarse leaf.

Cup Quality.—The liquor has the character which is usually associated with very young leaf. It is light in colour of cup and has indications of being somewhat overfired.

Infusion.—This is bright and is the best characteristic of the tea and rather leads us to suppose that the tea is well manufactured with the exception of being over-fired, but that the green leaf is lacking in essential oil.

The tea would sell on this Market in competition with low-grown Northern Indian Tea or Java, mostly for its appearance, its cup quality being unattractive.

To-day's value, the Market being on a very low basis, is about 11d."

(2) Description.	Character.	Value per lb.
Hand Made Bro-Or-Pekoe		1/3d.
Leaf	Black, even, well made, fair tip.	
Infused Leaf	Fairly bright.	
Liquor	Light, brisk. little high fired.	

Immature Tea Area.

This area consists of rising ground on Spur C at Tanah Rata. The land is mainly divided into 1-acre plots and was recently planted with the various jats as shown in the following table.

TABLE V.

Planting Arrangement on Spur C at Government Plantation, Tanah Rata, Cameron's Highlands, Pahang:—

Plot No.	Area in Acres.	Jat.	Date from Seed.
41	½	Dangri	January, 1928
42	½	Charali	March, 1927
43	½	,, Assam	March, 1927
44	1	Amulguri	March, 1927
45	1	Muttapong	January, 1927
46	¾	Betjan	March, 1927
47	¾	Dangri	January, 1928

Plot No.	Area in Acres.	Jat.	Date from Seed.
48	1	Betjan	January, 1928
49	1	Charali Manipuri	March, 1927
50	1	,, Assam	March, 1927
51	½	Dangri	January, 1928
52	1	,,	January, 1928
53	1	,,	January, 1928
54	1	,,	January, 1928
55	1	,,	January, 1928
56	1	Dhonjan	January, 1928
57	1	Rajghur	January, 1928
58	½	,,	January, 1928
59	¾	Dhonjan	January, 1928
60	1	Rajghur	January, 1928
61	½	Betjan	January, 1928
62	1	,,	January, 1928
63	1	Rajghur	January, 1928
64	1	,, (2nd generation)	October, 1929
65	1	Dhonjan	January, 1928
66	1	Charali	January, 1928
67	1	Rajghur	January, 1928
68	1	Betjan	January, 1928
69	1	Charali	January, 1928
70	¾	,,	January, 1928
71	1	,, Assam	January, 1928
72	¼	Betjan	January, 1928

The bushes in this area are all quite young, but are making excellent growth. Certain areas planted early in 1927 are so advanced as to be almost ready for plucking.

Seed of Manipuri tea Rajghur, sufficient to plant one acre, was recently obtained from tea seed bearers at Ginting Simpah (2,000 feet elevation) in Pahang. This seed was planted at stake in Plot 64 in October.

Also 3,000 tea seeds have been obtained from Escot Estate, Tanjong Malim, from seed bearers raised from seed originally imported from an up-country estate in Ceylon.

Soil Conservation.—Various systems of soil conservation are being undertaken including terracing, terracing with silt pits, and contour silt pits.

Cover plants have been established on certain of the plots, the most promising of these at present being *Dolichos Hosei* and *Indigofera endecaphylla*, although the former is troublesome owing to its climbing habit.

Shade Trees and Green Manures.—The following trees are being tried as shade trees and wind breaks:—*Acacia decurrens*, *Albizzia moluccana*, *Dalbergia assamica* and *Grevillea robusta*.

Erythrina lithosperma (thornless dadap), *Gliricidia maculata* and "Boga medeloa" *Tephrosia candida* are planted as green manures.

The writer is indebted to Mr. T. D. Marsh, Senior Assistant Agriculturist, Serdang, and Mr. J. P. K. Wilkins, Superintendent, Government Plantation, Cameron's Highlands, for the crop records published in this article.

REVIEW OF THE PRESENT POSITION OF RICE PRODUCTION IN MALAYA.

BY

W. N. Sands,

Acting Economic Botanist.

In May 1929, the Economic Botanist (Dr. H. W. Jack) read a paper before the Pan-Pacific Science Congress held in Java entitled "The Present Position in Regard to Rice Production in Malaya". In the following article the more important portions of that paper are given together with additional notes and certain statistical tables which have been revised in order to include later information.

Rice production and supplies have always ranked as a problem of first importance with the Government because the rice situation dominates all other industries and is necessary to the progress of the country.

Malaya is essentially a rice importing country since over sixty per cent. of the rice consumed has to be imported and as long as such supplies are readily available, abnormalities in local production have little effect, except in Pahang and in the Unfederated Malay States situated along the East Coast of the Peninsula. Nevertheless, local production is of material importance since food crises must be regarded as periodic and liable to arise at comparatively short notice.

Moreover, during the past twenty years, the imports of rice into Malaya have increased enormously, chiefly on account of the increasing prosperity of the country following the introduction and rapid development of the rubber industry and the growth of tin mining. These two industries have combined to attract labourers from neighbouring countries in great numbers so that they now comprise approximately half of the entire population. These labourers have no facilities for producing rice—their staple food—and it is mainly in order to feed these immigrant labourers that the imports of rice have increased so extensively and must be maintained.

The Malay population has grown rapidly during the same period and an appreciable percentage of it has been drawn away from rice planting by the more remunerative attraction of rubber cultivation; nevertheless, except in a few districts, the Malays have steadily maintained their production of padi, the total acreage planted last season in the Peninsula being 687,000 acres.

It should be mentioned that the bulk of the Malay padi cultivators dwell in the Unfederated States where rubber cultivation is still in its infancy and where wage earning facilities are comparatively scarce so that they have to grow rice of necessity or do without it. In these territories the area planted for the 1929 crop was 436,000 acres, which represents 63% of the total for Malaya.

Imports of rice, as already mentioned, are related to a considerable extent to the condition of the rubber and tin industries. If these enterprises are flourishing then there is a large influx of coolies with a corresponding increase in imports and consumption.

Table I shows the local production together with imports and values of rice since 1918. It also gives the percentage of rice produced to that imported. The total consumption figures are based on the totals of production plus imports.

In converting padi into terms of rice, 700 gantangs of padi have been taken to yield one ton of clean rice, whilst 300 gantangs (Imperial gallons) of rice are calculated as equal to one ton.

TABLE I.

Rice Production and Imports, Malaya.

Year.	Production. tons Rice.	Nett Imports, tons Rice.	Consumption, tons.	Production to Imports.	Production to consumption.	Value of Nett imports. $
1917-1918	178,482	344,000	522,482	52	34	33,157,000
1919	178,875	370,000	548,875	48	33	63,642,000
1920	153,690	336,000	489,690	46	31	101,517,000
1921	254,538	234,000	488,538	109	52	13,911,000
1922	201,038	364,000	565,038	55	36	25,500,000
1923	223,444	361,656	585,100	62	38	39,618,106
1924	213,074	394,282	607,356	54	35	48,893,492
1925	227,336	403,058	630,394	56	36	49,437,212
1926	171,449	474,847	646,296	36	26	61,765,380
1927	183,391	545,718	729,109	34	25	68,363,213
1928	193,038	523,770	716,808	37	27	62,692,772
1929	180,328	555,539	735,867	32	25	57,911,429
Average	197,000	409,000	606,000	48	32½	

The more interesting facts brought out in the above table are:—

(a) Local production, after due allowance for bad seasons, has been fairly well maintained.

(b) Production is only about one-fourth of consumption.

(c) Consumption has greatly increased during the past 10 years.

(d) Imports now average about 525,000 tons per annum.

(e) The average value of the imports for the last four years is 62½ million dollars (£7,353,000).

There has been a large and steady increase in population in Malaya during the last decade, the total population being now estimated at about 4 millions. If, as is usually estimated, 1 lb. of rice per head per day is required, the consumption figure would be 652,000 tons per annum as against the total shown in the table of 736,000 tons, so that allowance must be made for losses in storage and distribution, carry over stocks, possible errors in import and production weights and in other ways.

Straits Settlements.

Table II shows the production of rice in the Straits Settlements. The trend of production is downward until cultivators began to feel the effects of the rubber slump in 1920 and thereafter crops were large until 1925 when rubber became profitable again. The sudden revival of rubber during 1925 caused a decrease in production in 1926, but the quick fall in rubber in 1926 was again followed by increased rice production in 1927, 1928 and 1929.

Rice imports into the Straits Settlements for consumption are about 180,000 tons annually.

TABLE II.

Production in Gantangs of Padi. Straits Settlements.

Year.	Malacca.	Province Wellesley	Penang and Dindings.	Totals.	Totals. Tons of Clean Rice.
1918	8,111,600	6,734,500	2,031,000	16,877,100	24,110
1919	6,873,400	7,325,000	1,580,125	15,778,525	22,541
1920	6,764,250	7,573,969	2,316,350	16,654,569	23,792
1921	7,887,700	10,150,000	4,028,850	22,066,550	31,524
1922	8,486,024	10,291,000	2,668,300	21,445,324	30,636
1923	8,525,582	14,350,000	2,110,515	24,986,097	35,694
1924	9,945,954	13,400,000	2,056,060	25,402,014	36,289
1925	0,795,332	9,553,500	2,390,500	22,739,332	32,485
1926	18,172,900	7,478,000	1,098,500	16,749,400	23,928
1927	8,303,706	8,600,000	2,426,750	19,330,456	27,615
1928	8,913,849	10,942,000	2,478,200	22,334,049	31,906
1929	9,588,337	11,624,200	2,179,080	23,391,617	33,417
Averages.	8,530,720	9,835,181	2,280,353	20,6416,253	29,949

No rice is produced in Singapore. The ratio of production to imports in Malacca is approximately 4 : 5 whilst in Penang and Province Wellesley (and including the Dindings) the ratio is roughly 1 : 2.

In Penang alone, only a very small percentage of the population is engaged in padi cultivation.

In Province Wellesley, there is a fair production of rice amounting roughly to 14,000 tons per annum and the ratio of production to imports in this area is about 2 : 3.

Federated Malay States.

Table III shows that the production of rice in the Federated Malay States has not varied greatly except in the 1924—25 season when the slump in rubber left Malay cultivators with little cash to purchase rice, so that the rice fields were cultivated more extensively than usual.

The reduced production in 1919 was the direct result of the influenza epidemic during 1918—19 season, while the large drop in 1927 was due to the severe floods during 1926—27 season, when many acres of padi in Perak and Pahang were entirely destroyed.

Most of the immigrant labour in Malaya is employed in the Federated Malay States and consequently the imports of rice varied with the variation in rubber and tin prices, except during the abnormal years of shortage of supplies.

TABLE III.

Rice Production and Imports, Federated Malay States.

Year.	Production tons of clean rice.	Import in tons of clean rice.	% Production to Import.	% Production to Consumption.
1918	42,959	127,823	34	25
1919	38,298	164,059	23	19
1920	49,308	129,117	38	27
1921	49,350	107,176	46	32
1922	53,890	117,058	46	32
1923	54,245	127,747	42	30
1924	53,093	137,323	39	28
1925	66,069	157,458	42	30
1926	46,983	185,903	25	20
1927	31,663	182,778	17	15
1928	44,348	180,000	25	20
1929	45,137	180,000	25	20
Averages	47,945	149,704	34	25

Unfederated Malay States.

Whereas the average annual production of rice in the Federated Malay States is only 48,000 tons, that of the Unfederated Malay States is 120,000 tons. In these States, the population is almost entirely Malay and the rubber and tin industries do not enter so prominently into the economic life of the population as elsewhere in the Peninsula.

TABLE. IV.

Production in 1000 gantangs of Padi, Unfederated Malay States.

Year.	Perlis.	Kedah.	Kelantan.	Trengganu.	Johore.	Total.	Tons of clean rice.
1918	5,324	38,315	30,000	3,000	1,350	77,989	111,413
1919	5,000	43,227	30·000	3,000	1,400	82,627	118,039
1920	4,077	27,186	21,000	2,500	1,650	56,413	80,590
1921	5,792	69,280	42,596	3,000	897	121,565	173,664
1922	5,847	37,302	33,924	3,000	1,485	81,559	116,513
1923	7,362	48,452	33,799	3,000	840	93,453	133,504
1924	8,076	40,809	34,040	3,000	660	86,584	123,691
1925	6,737	50,733	28,527	3,000	1,150	90,147	128,781
1926	9,048	32,780	25,025	3,000	511	70,363	100,519
1927	9,014	56,274	18,751	2,500	341	86,879	124,113
1928	5,434	53,236	18,834	3,000	1,245	81,749	116,784
1929	5,859	45,306	14,996	3,000	2,088	71,241	101,773
Averages	6,464	45,242	27,624	2,917	1,135	83,381	119,115

Normally, the States of Perlis and Kedah are self-supporting and usually export padi to the mills of Penang and Perak. Until a few years ago Kelantan, too, was self-supporting, but poor crops together with the increase of rubber cultivation in that State with its attendant influx of immigrant coolies and the

opening up of the country by railway development have necessitated annually increasing imports of rice during the past decade.

Trengganu and Johore have been large importers of padi for many years, since in Trengganu the bulk of the population live along the sea coast and are mainly engaged in the fishing industry, and in Johore, rubber, coconuts and other products have proved more lucrative to the Malay population than padi cultivation.

With the exception of Johore, the production of rice in the Unfederated States is, as yet, little affected by the competition of rubber, though in Kedah, thousands of acres are already producing rubber.

Thus, the total production of rice in the Unfederated States shows little variation from year to year, though bumper crops were reaped in 1921 in Kedah and Kelantan. In Kelantan, the influenza epidemic in 1918-19 was responsible for the very small crop in the 1919-20 season and severe floods had a similar effect in 1927, whilst drought was the disturbing factor in 1928. Exceptionally bad weather conditions in Kedah in 1920 resulted in a poor crop that year. High rubber prices and poor weather conditions were the cause of the small crop in Kedah in 1926.

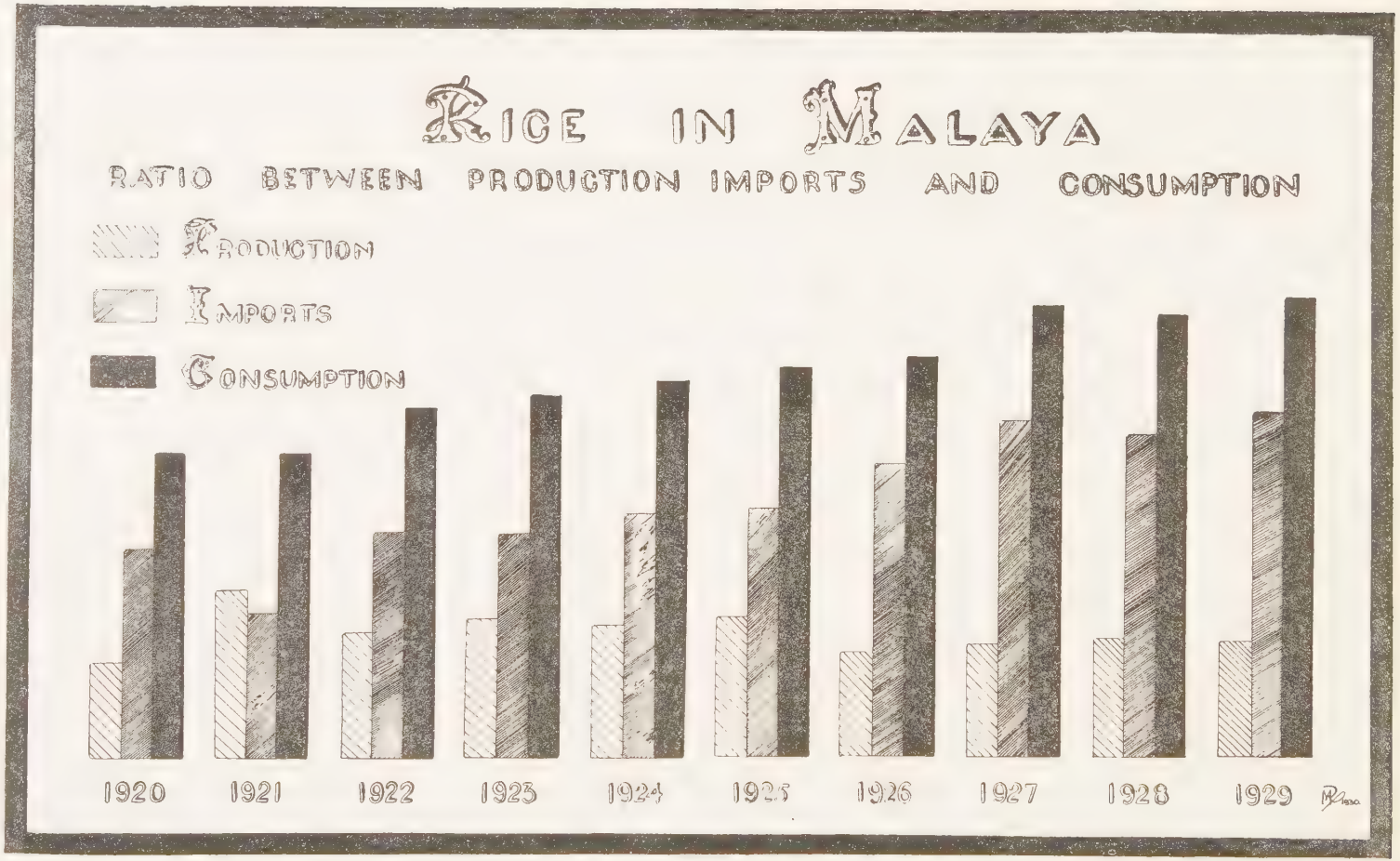
Figures of imports of rice into the Unfederated States on the East Coast are not very reliable for though almost all of the rice is shipped from Singapore it is said that fishing folk also import quite a lot from the smaller passing trading ships of which no record is taken.

The annual production of rice in Kelantan is roughly 12,000,000 gantangs of rice and the recorded imports now amount to some 4,000,000 gantangs in a normal year, though this amount is probably exceeded for the reason given above and is certainly exceeded in poor crop years. The ratio therefore between production and imports is in the neighbourhood of 3 : 1 though this ratio is by no means stable since rubber cultivation and other crops are gaining in competition with padi, so that rice imports are likely to increase.

In Trengganu, production averages 1,250,000 gantangs of rice or enough to feed about 30,000 of the population of 165,000; consequently, nearly 6,000,000 gantangs have to be imported annually; therefore the ratio of production to imports is approximately 1 : 5.

In Johore, the low production of some 420,000 gantangs of rice is only capable of feeding some 9,000 people while 310,000 must be fed from imported supplies; thus the ratio of production to imports is about 1 : 34.

Johore has a large area under rubber on which immigrant coolies are employed almost exclusively. The Malays also maintain important rubber, coconut, arecanut and fishing industries, so that only a very small percentage of the population has the facilities for rice cultivation—hence the extremely low production.


RICE IN MALAYA
RATIO BETWEEN PRODUCTION IMPORTS AND CONSUMPTION
PRODUCTION
IMPORTS
CONSUMPTION
1920
1921
1922
1923
1924
1925
1926
1927
1928
1929

As already mentioned, Perlis and Kedah are self-supporting, though the rapid increase in the area under rubber in Kedah is likely in time to affect its present fortunate situation as regards food production.

The average ratios between the production of rice in the different States of Malaya and the imports are depicted graphically on the opposite page and need no comment.

As shown, Malaya imports two-thirds of its local rice consumption, so that should imported supplies be curtailed in any way, the seriousness of the food problem would immediately become apparent.

It is not long since the country suffered from a shortage of supplies and as a similar shortage is always possible again, methods must be devised to meet any possible crisis which may arise.

TABLE V.

Summary of Production of Padi in Malaya.

In Gantangs (one gantang = one Imperial Gallon).

Season.	Federated Malay States.	Straits Settlement.	Unfederated Malay States	Malaya.	Tons of Rice.*
1917-18	30,071,214	16,877,100	77,989,000	124,937,314	178,482
1918-19	26,808,837	15,778,525	82,627,000	125,212,362	178,875
1919-20	34,515,636	16,654,569	56,412,510	107,582,715	153,690
1920-21	34,544,837	22,066,550	121,565,448	178,176,835	254,538
1921-22	37,723,059	21,445,324	81,558,533	140,726,916	201,038
1922-23	37,971,530	24,986,097	93,453,323	156,410,950	223,444
1923-24	37,165,363	25,402,014	86,584,295	149,151,672	213,074
1924-25	46,248,330	22,739,332	90,147,276	159,134,938	227,336
1925-26	32,888,134	16,749,400	70,363,217	120,000,751	171,429
1926-27	22,164,045	19,330,456	86,879,344	128,373,845	183,391
1927-28	31,043,556	22,334,049	81,749,436	135,127,041	193,039
1928-29	31,596,196	23,391,617	71,241,497	126,229,310	180,328

* Calculated on the basis of 700 gantangs of Padi to one ton of clean rice.

The problem of increasing and encouraging production is one that concerns the whole of Malaya, and the extremely unsatisfactory position which is shown to exist calls for an early enquiry into the possibility of enlarging considerably the output. There are already large padi areas in the Peninsula possessing a settled agricultural population, which have received little consideration from this standpoint. Take for example, the Unfederated States of Kedah, Perlis, Kelantan and Trengganu, where about 436,000 acres are annually planted and produce 120,000 tons of rice. In these places there are great possibilities; still irrigation problems have hardly been touched, and crops are good or bad according to whether the rainfall is ample or deficient. Again, scientific help and advice with reference to seed-selection, manuring, cultivation and control of pests is either not available or only so to a very limited and quite inadequate extent.

Production is already stimulated in most States by the remission or reduction of rent or premium on land suitable for rice; by assisting in the upkeep of irrigation works and water channels; distribution of selected seed and in other ways.

The investigation of new areas likely to be suitable for rice growing if irrigated, drained and settled, is another line of action which is being pursued; but this work, although most important, is necessarily slow and a much longer time is required to obtain results than by the improvement of existing areas.

THE MANUFACTURE OF BANANA FLOUR.

BY

F. S. Ward,

Assistant Mycologist.

The manufacture of Banana Flour in Malaya was first exploited as a commercial proposition by a Singapore firm in 1924. It appears that the industry offered considerable possibilities but the chief difficulty was to obtain an adequate supply of fruit and to avoid an unfair rise in prices.

The following is an extract from the "Straits Times," dated August 6th, 1924, which refers to the manufacture of Banana Flour as one of the new Malayan industries.

> "In a shed equipped with the necessary machinery, a number of manufactures are being carried on, not the least interesting of which is production of flour from locally grown bananas for export to Europe. In fact, there are orders in hand for this flour from Europe, and it is hoped to meet the demand with the necessary machinery. At present, the standard of the quality of the flour turned out is up to the required standard, but the quantity obtained is not satisfactory; it is only a matter of time, however, before an improvement in the quantity obtained will be effected. Banana Flour is used at the present time in Europe as a raw material for bakeries etc. in the manufacture of chocolate, biscuits, cakes and also as a beverage mixed with Cocoa and Milk."

After experimenting with different kinds of bananas, it was found that the plantain, Pisang Tandok, gave the best results. The true banana, in any of the varieties tried out, did not give satisfactory flour, or could not be made into flour at all. There are two kinds of Pisang Tandok, one nearly white with a green skin and one red. Both are used in the preparation of the flour, which consequently has a yellow colour. Flour from the white variety is almost white, but it is possible that the full colour might lead to the idea that the flour is adulterated with some form of starch and consequently a preference for the preparation of flour with a distinctive colour is created. It is probable that Pisang Embun is the second most satisfactory variety for the manufacture of banana flour, although in the event of this variety being seriously affected by Panama Disease, there seems no reason why other varieties, so far found to be immune to this disease in Malaya, such as Pisang Serendah, Pisang Mundan, Pisang Masak Hijau etc. should not give satisfactory results.

In 1924, the supply of fruit was being obtained from Batu Pahat in Johore. The first price asked by the growers was $9 per thousand. For the second consignment the cost was $10 per thousand and another consignment cost $13

per thousand. The fruit was brought to the factory in a motor lorry, the journey costing $30; including duty in Johore, handling and transporting, the last consignment of fruit cost 1.81 cents each. This figure was rather high but could not be reduced until more experience was gained and other sources of fruit supply could be found. Now that there is an increased acreage of bananas under cultivation there is no doubt that this figure could be considerably reduced.

At the time when banana flour was being manufactured at Siglap the growers would not allow any selection of the fruit for size. Large and small had to be taken together in each lot of 1,000. For transportation purposes the "hands" were cut off the bunch and the individual fruits were left attached to the stalks of the hand in order to prevent them from ripening too quickly in the factory.

Procedure in the Manufacture of Banana Flour as carried out Locally.

In Singapore, the flour was manufactured by a "Sirdar" Flour Mill, provided by E. R. and F. Tinner Ltd. of Ipswich, England, mainly for use in India. The price was about $250 and was capable of producing two tons of flour a day. The mill was driven by a motor of 4 H.P. on the break; this was capable of driving slicing machines as well.

Near a table for peeling the fruit by hand is a treadle sewing machine fitted with a knife for slicing the fruits. The fruits are cut transversely, about one twelfth of an inch thick. Slicing costs about one cent per pound of flour for labour.

Two hot-air dryers were used which were made on a German pattern. One was purchased in Germany for $200, and the other was a copy of the first and was made locally for $60, the dryer apparently not being protected by patent in Singapore. Each dryer is about two and a half feet square in cross section and about ten feet long. The dryer is placed at an angle of about thirty degrees with the horizontal. At the lower end is a hole to admit the top of a closed stove. The dryer contains six tiers of trays, with six trays in each tier. At the top end are a ventilator and a door by which the ventilation can be controlled. The trays are shallow wooden frames about thirty inches square with floors of fine wire gauze. Some locally made trays have floors made of wicker-work. Each dryer will dry five hundred bananas in twenty-four hours.

The whole fleet of cutters and dryers can be made locally at comparatively small cost and can be increased indefinitely.

In the process of manufacture, the fruits are cut from the "hands" and peeled by a Chinese coolie using a special knife. A Chinese boy then slices them in the slicing machine. The slices are laid in the drying trays and are dried for a few hours in the sun to remove part of the moisture. The trays are then put into the top end of a dryer and kept at a temperature not exceeding

fifty degress Centigrade for twenty-four hours. The finished trays are then removed from the lower end of the dryer.

When the dried slices are sufficiently desiccated they are ground into flour which is sifted through a fine mesh sieve and packed in locally procured tins containing a half kilogramme each. The tins are packed in cases containing sixty tins each.

The average production is twenty per cent by weight of flour from the fresh fruit, including the skins and the stalks of the "hands."

Approximate Cost of Production.

On a large plantation, the cost of the bananas would be considerably less than when bought in the open market, the cost of the fuel would be practically nil and transport costs would be reduced when the flour is tinned. Against this we have the costs of planting up a banana estate from jungle. The cost of felling jungle at the present time varies from $12 to $18 per acre, largely depending upon the density of the jungle. The following is an estimate prepared in 1924.

For planting 10 ft. by 10 ft. = 435 banana suckers per acre.

Felling jungle	...	$10 per acre
Clearing and burning	...	2 ,,
Holing (extra size)	...	15 ,,
Planting	...	5 ,,
		$32 per acre

In this estimate the cost of suckers and manuring (in the case of the second crop) is not included. Weeding charges would average $2/- per acre for the first six months and $1/- per acre per month afterwards.

A leguminous cover crop would have to be established to retain as much moisture as possible.

The crop from Pisang Tandok is ready for harvesting within one year of planting the suckers, and the yields per acre have been estimated as follows:—

Say 400 plants bearing 400 bunches at 30 fruits per bunch = 12,000 fruits per acre.

The yield of fruit from this variety in actual numbers is less than other varieties.

The manufacturing costs covering one actual consignment of fruits in Singapore, in 1924, were as follows:—

12,941 plantains (Pisang Tandok) at 1.83 cents each		$236.82
Wages 4 coolies, and one mandor for two weeks	...	55.00
Wood fuel	...	16.00
Motor	...	4.00

986 tins at 4 cents each	...	39.44
Labels at half a cent each	...	4.93
Tin smith at 1 cent per tin	...	9.86
20 cases at 50 cents each	...	10.00
		$376.05

From the above consignment, 551 kilogrammes of flour were obtained and the price realised was 75 cents per kilogramme f.o.b. Singapore.

551 kilogrammes of flour at 75 cents per kilogramme = $413.25

Profit therefore is $413.25—$376.05 = $37.20.

The freight paid by the buyer of the flour cost about 14 cents per kilogramme. The total cost of the Singapore banana flour in Belgium is, therefore, 89 cents per kilogramme. The current market prices at the time in Belgium for Banana Flour from the West Indies was:—

Wholesale—6 francs per half kilogramme = 60 cents.

Retail—7.30 francs per half kilogramme = 73 cents.

This compares in 1924 with 45 cents per half kilogramme for the Singapore flour, but with increased production and experience it is possible that the cost price could be reduced, allowing a larger profit to the manufacturer in Singapore, while still providing a good margin for possible competition in the European market.

In view of the possible demand for Pisang Embun in the manufacture of banana flour, the market prices at the present time, as quoted by a Chinese dealer at Jelebu, are as follows:—

In Titi, which is in the Jelebu District	...	$1.80 per picul
In Kuala Lumpur	...	2.50 ,,
In Singapore	...	3.00 ,,

Taking one picul of bananas on the stalk as equivalent to eight bunches, and each bunch averaging seven hands at ten fruits per hand, the number of fruits per picul would be 560 which would be approximately twice the number of fruits per picul of Pisang Tandok. This estimate for the number of fruits per picul of Pisang Embun is a conservative one as it is a common occurrence in some districts to find bunches averaging about a hundred fruits or more per bunch which would figure out at 800 fruits per picul on the above estimate.

As compared with Pisang Tandok, the cost price for Pisang Embun fruit is considerably less than the Pisang Tandok in 1924. Estimating on the above basis, the cost price per Pisang Embun fruit would be as follows:—

In Titi	$\frac{1.80 \times 100}{560}$	=	.321 cents
In Kuala Lumpur	$\frac{2.50 \times 100}{560}$	=	.446 ,,
In Singapore	$\frac{3 \times 100}{560}$	=	.535 ,,

Reckoning on 12,941 (see above) as the figure for a consignment of Pisang Tandok plantains in 1924 and substituting the above cost prices of Pisang Embun per fruit for the cost price of Pisang Tandok per fruit, the manufacturing costs for a consignment of 12,941 Pisang Embun bananas would be as follows:—

In Titi	...	12,941 × .321 = $41.54
In Kuala Lumpur	...	12,941 × .446 = $57.71
In Singapore	...	12,941 × .535 = $69.23

From the consignment of 12,941 Pisang Tandok plantains in the 1924 estimate, 551 kilogrammes of flour were obtained. This consignment of 12,941 Pisang Tandok plantains represents about twice the amount by weight of a similar number of Pisang Embun bananas. The fingers of Pisang Tandok measure about one foot long and two inches in diameter as compared with the fingers of Pisang Embun which are from six to eight inches in diameter. In order, therefore, to produce 551 kilogrammes of banana flour from Pisang Embun bananas it would be necessary to have approximately 12941 × 2 = 25882 bananas of this variety. The manufacturing costs—taking the Singapore estimate given above as a basis—would be as follows, allowing another $30 for the extra labour involved and assuming the same percentage weight of flour is obtained from the two varieties.

	In Titi	*In Kuala Lumpur*	*In Singapore*
25,882 Pisang Embun bananas ...	$83.08	$115.42	$138.46
Wages, 7 coolies and one mandor for two weeks ...	85.00	85.00	85.00
Wood fuel ...	16.00	16.00	16.00
Motor ...	4.00	4.00	4.00
986 tins at 4 cents each ...	39.44	39.44	39.44
Labels at half a cent each ...	4.93	4.93	4.93
Tin smith at 1 cent per tin ...	9.86	9.86	9.86
20 cases at 50 cents each ...	10.00	10.00	10.00
	$252.31	$284.65	$307.69
551 kilogrammes at 75 cents per kilogramme ...	$413.25	$413.25	$413.25
Profit —	252.31	284.65	307.69
=	$160.94	$128.60	$105.56

The profit per acre as realised in Singapore in 1924 from Pisang Tandok flour, allowing 400 plants per acre and 30 fruits per bunch was

$$\frac{37.27 \times 12000}{12941} = \$34.56$$

The profit per acre from Pisang Embun flour, taking the figures as given by a Chinese dealer in bananas at Jelebu would be approximately as follows:—

In Titi.

$$\frac{160.94 \times 28000}{25882} = \$174.11$$

In Kuala Lumpur.

$$\frac{128.60 \times 28000}{25882} = \$139.12$$

In Singapore.

$$\frac{105.56 \times 28000}{25882} = \$114.20$$

These figures show a considerable profit per acre, where the manufacture of banana flour is carried out near the centre of production, as compared with the following approximate estimate of profits per acre, per annum obtained by selling the fruit in the open market.

In Titi.	*In Kuala Lumpur.*	*In Singapore.*
$90.00	$125.00	$150.00

The figures given for the banana fruit sold in the open market do not include the cost of upkeep (which would be about 20% of the profits per acre per annum) and transportation charges, therefore the profit would be considerably less as regards the Kuala Lumpur and Singapore figures which would be reduced by at least 25% and 40% respectively, for transportation alone, owing to these places being long distances from the centre of production which in this particular case is the Jelebu District.

The above figures are purely rough approximations but a sufficiently wide margin has been left so that they will not be misleading. As compared with the profits which have been made in the past in banana growing, the above are conservative estimates, although it must be understood that these profits are not obtainable until about the third year, only a small profit being made during the second year owing to considerable initial expenditure, such as opening up and preparation of the land. The following quotation refers to the profits which have been made in the cultivation of the Chinese banana *(Musa cavendishii)* in Trinidad (the variety is the same as the Pisang Serendah in Malaya).

"From a field of Governors of five acres planted in 1904, which had received a dressing of 40-50 tons of pen manure per acre in 1908, the heavy return of 4,596 stems was reaped or 919 per acre, and as our stems shipped for the past year netted the low average of 21½ cents each on the market, even this small price will show a return of nearly $200 (Gold) per acre, while our average expenditure for the year was slightly under $40 (Gold) per acre."

Uses and Possible Markets.

Banana flour can be used with milk and sugar to make a food for invalids or children. A Singapore doctor considers the flour very nourishing and easily digestible. It can also be used, mixed with wheat flour, for making cakes and puddings, for flavouring chocolate and for similar confectionary purposes.

At the meeting of the British Medical Association in July 1910, Dr. Eric Pritchard* recommended the use of banana flour in infant feeding. He stated that it was cheap and wholesome, rendered the milk more digestible and possessed a high nutritive value. He has for many years recommended the addition of mashed banana to the milk mixtures with which babies are fed when the natural source is unavailable. As the result of further experiments, he proposes the substitution of banana flour, made into a gruel or decoction, for the more expensive proprietary infant foods. It is of great importance that infants should be trained early to digest cows' milk. This cannot be done by giving them artificial substitutes which are predigested. The use of cereal decoctions and solution of gum or gelatine undoubtedly makes the digestion of cows' milk easier, and Dr. Pritchard finds that a decoction of banana gruel has many points of recommendation. It can be made in a few minutes by rubbing up a heaped table-spoonful (1 oz.) of banana flour with a pint of water, and then boiling for five minutes. A gruel made in this way has excellent colloidal properties when added to milk in equal quantity; it thickens the milk and prevents formation of a leathery coagulum of casein, and satisfies the appetite of hungry infants more effectually than simple milk dilutions.

Banana flour can be obtained under the name of "Bananine," of which the Lancet† speaks highly in the following terms:—

"There can be no doubt of the nutritious character of banana flour, and the starch in it is peculiarly easy of solution and digestion in the alkaline digestive juices of the body. Banana flour is readily dissolved, for example, by the saliva. Our analysis of 'Bananine' gave the following results:—Moisture 14.60 per cent; mineral matter 2.20 per cent; proteid 19.22 per cent; fat 2 per cent; and carbohydrate 61.98 per cent. The flour has the peculiar flavour and odour of fresh banana fruit. We have received also a sample loaf, made with 'Bananine' flour. The flour proves to make a very acceptable loaf, uniform in texture and permanently moist and of a golden colour."

It has been difficult to make banana bread unless the banana flour is mixed with a large proportion of wheat flour, but bread of an agreeable taste has been obtained by making a paste of the banana flour, and then submitting to the action of steam under pressure.

"Bananine" is prepared by a Liverpool firm, the Banana Bread Flour Food Ltd., 16 Brunswick Street. Banana Flour and other banana preparations are also manufactured by Pattinson Banana Fruit Foods, Ltd., Anerley, London, S.E. The banana flour is vouched for in their circulars as follows:—"Dr. Conrad Stich, the food expert of Leipzig writes: 'I have carefully analysed and tested your banana flour, and have noticed how peculiarly soluble it is. By the addition of hot water the whole of the flour is made perfectly soluble and in a form suitable for digestion. Four-fifths of the flour consists of

* British Medical Journal, October 15, 1910.

† The Lancet, October 17, 1903.

soluble carbohydrates. It is particularly suited for patients recovering from typhoid fever, and is excellent in cases of Choluria, dysentry, and similar stomachic complaints. In cases of chronic dyspepsia and gastritis, the banana flour properly prepared is easily digested. I consider that as an infants and invalids food the flour properly prepared has a great future. The nitrogenous portion of the flour is of great value, being of a fruit nature and remaining quite soluble in the flour."

In 1924 there was a considerable market for the flour in France and Belgium. A Norwegian firm of good standing applied for the sole agency for the banana flour from Singapore. Japanese landowners at Batu Pahat proposed the formation of a joint company to produce the flour from plantains grown by them. When this proposal was not agreed to, they offered to purchase the existant factory, but this proposal also was not agreed to. The proposals made, however, indicate the possibility of a market in Japan, and possibly a market could be found in China, Australia and perhaps India.

It appears that in 1924, the Banana Flour industry offered definite possibilities. The cost of the plant is not very high and at the same time it could be run economically if, for instance, the heat from the flues of the banana dryers could be used for drying copra in areas where coconuts are abundant, in which case the coconut husk could be used for fuel. The markets for the flour then existant were probably limited but appeared to be capable of extension.

The main difficulty in 1924 was to obtain an adequate supply of fruit and to avoid an unfair rise in prices. If an area of land could have been obtained in a favourable situation near a port in the Peninsula to grow sufficient plantains to keep the factory running, it would have proved a more suitable site than the factory in Singapore Island.

Later advices from Belgium showed that if the production of banana flour in Singapore was to prove successful the cost of production must be reduced. The cost of fuel and transport were on the high side, but the very high cost price of the fruits proved the bar to successful manufacture in this particular instance.

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THE SCHOOL OF AGRICULTURE, MALAYA.

BY

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Agricultural Instructor.

It is now common knowledge that a School of Agriculture is to be established in the near future at Serdang, near Kuala Lumpur, as a joint institution for the Federated Malay States and the Straits Settlements. Proposals for such a School are, however, by no means of recent origin, for both the Department of Agriculture and the Education Department have, during the past fifteen years, repeatedly urged the necessity of providing facilities for educating the inhabitants of this country along agricultural lines. That this necessity has existed for a number of years is evident from the findings of a Committee which was appointed by the Federal Government as long ago as early 1914 to consider the desirability of establishing locally a College of Tropical Agriculture. The Committee was not favourably disposed towards the suggestion, with the result that the projected institution eventually materialised not in Malaya but in Trinidad, as the Imperial College of Tropical Agriculture. It was considered that there was at that time a far more urgent need in this country for a system of agricultural training which should start at the bottom and work gradually upwards: in other words, that the demand for higher training of the standard associated with an agricultural college was insignificant in comparison with the very real and urgent need for such elementary and intermediate forms of instruction as lie within the province of an agricultural school and which, under efficient organisation, might reasonably be expected to lead in the course of a few years to a steady improvement in the standard of agriculture as practised by the native Malays and other Asiatic agriculturists in the Peninsula. The views expressed in 1914 were unquestionably sound; but, unfortunately, the proposals submitted by the Committee were destined to encounter obstacles which were as serious as they were unforeseen. The Great War broke out in the same year; and, with the general upheaval and financial uncertainty which followed, it is but natural that the recommendations were not put into practice, in spite of their sound foundation.

The desirability of providing facilities for agricultural education in Malaya was not lessened by the non-acceptance of these original proposals, although some years elapsed before they were revived. The Director of Education visited the Dutch East Indies and the Philippines in 1917 in connection with the question of industrial education, and was much impressed by the prominence given in Java and elsewhere to agricultural training. Further, in 1921, an officer of the Department of Agriculture visited Ceylon in order to study the conditions of agricultural education which obtain in that country; and, on his return to Malaya, submitted proposals for the establishment of a Central School

of Agriculture for the purpose of training not only Malay Officers in the Department of Agriculture but also the sons of well-to-do landowners of Malay and other nationalities. The proposals were again destined to prove unacceptable, however, owing to the financial economies necessitated by the general trade depression of 1921-22.

It is nevertheless evident that, by this time, the necessity of providing technical education, not only in agriculture but in other industrial directions as well, was developing a more and more serious aspect. The situation, in fact, had become acute by 1925, in which year the Technical Education Committee in Singapore reported as follows:—

"Though agricultural education is commonly differentiated from technical education, the importance of agriculture in the development of Malays must be our excuse for urging the need for one or more Agricultural Schools where all the operations of rubber planting can be taught to local boys so as to enable them to take charge at any rate of small estates with knowledge and success. Soil amelioration, planting, the diseases of trees, the preparation of latex, estate book-keeping, estate health will occur to everyone as essential subjects of the curriculum. A course in poultry-farming would be valuable. As we have already remarked, the Federated Malay States are geographically the centre for agricultural education. And we are of opinion that the Colony should co-operate financially with the Federal Government in any scheme which it may have for a school of practical agriculture provided students from the Straits Settlements are admitted. If the Federal Government is not prepared to co-operate, then the Agricultural and Education Departments should be required at once to draw up a scheme for this type of education in the Colony. In our view.....it is the most important educational need of the moment. Not only should it provide careers for many youths, but it should help to save many thousand acres of native rubber from destruction."

Anyone familiar with Asiatic small-holdings in Malaya will agree that, so far as rubber is concerned, their "destruction" is a very remote contingency. Nevertheless it will be generally admitted that they do present considerable opportunities for all-round improvement; and, following the above report, a Committee was appointed by Government in 1926 to draw up a scheme for a School of Agriculture as a joint institution for the Federated Malay States and Straits Settlements. The Committee was composed of the Secretary for Agriculture, the Director of Education, the Chief Inspector of English Schools and the Agricultural Economist; and in its report, which was tabled as Federal Council Paper No. 12 of 1927, the existing position of agricultural education in Malaya was analysed, and definite proposals were submitted for the establishment of a School of Agriculture at Serdang. It was pointed out that the existing provision for elementary agricultural education was limited to the training in rural science of future vernacular school teachers at the Sultan Idris Training College, Tanjong Malim, the encouragement of school gardens, and the publication by the Department of Agriculture of quarterly journals in Malay

and Chinese containing articles of importance and interest to Asiatic cultivators in this country; while agricultural education of an intermediate nature did not exist outside the training given at the Department of Agriculture to a handful of Malay students recruited annually with a view to filling departmental appointments on the conclusion of their training. Even the instruction given to these students was considered to be less satisfactory than it might be, the main objection being that Kuala Lumpur itself was, in more ways than one, an unsuitable centre for such an undertaking, while two years' training was considered to be insufficient for local students in view of their general backwardness when recruited.

The Committee invited the views of various influential gentlemen and of the representatives of local agricultural bodies such as the Planters' Association of Malaya as to the immediate value of the proposed school and the general nature of the instruction which should be offered, and the conclusion was reached that a School of Agriculture should be definitely established at Serdang under the control of the Department of Agriculture and that two courses of instruction should be provided: (a) a Three Years Course, calculated to give students who had passed the Cambridge Junior or Senior Local Examination a thorough grounding in the principles and practice of scientific agriculture, and (b) a Two Years Course, of an essentially practical nature, with special reference to rubber, coconuts, oil palms and such other agricultural products as might prove suitable for estate cultivation in Malaya.

The recommendations submitted by this Committee were accepted in principle by Government, and an Advisory Committee was appointed to investigate in detail the manner in which the proposals should be put into effect. The choice of site presented little difficulty, an area of nearly 40 acres being placed at the disposal of the School at the entrance to the Government Experimental Plantation, Serdang, about 14 miles from Kuala Lumpur. The jungle was soon felled, burnt and clean-cleared, leaving an almost square area of flat land ideal for the erection of the school buildings, the establishment of cultivation plots, and the provision of playing fields. It was eventually decided that the building programme should be undertaken by the Public Works Department. Preliminary plans were prepared and were approved early in 1929 for a school and hostel suitable for the accommodation of eighty students: the school to comprise four lecture rooms, two laboratories, museum, library, and offices, and the hostel containing four large dormitories, a students' common room, and the necessary dining room and kitchens. Quarters for the school staff were actually in course of erection by August, 1929, while the building of the school and hostel was begun in January, 1930, in anticipation that the school should be opened about the middle of 1931.

Meanwhile, the question of a detailed syllabus of instruction for each of the suggested courses demanded further consideration, and the Advisory Committee came to the conclusion that the original proposals relating to the junior course should be modified in certain important particulars. In the first place,

the scheme as it then stood contemplated a Two Years Course, conducted in English, with a view to meeting the requirements of estate cultivation. It is very doubtful whether such a course would make any real appeal to the people whom it is in many ways most desirable to benefit, namely the Malay raiat and the poorer Chinese and Indian agriculturists, on account not only of the language difficulty but also the expense to individual students which two years' residence at Serdang would entail. It was felt that the junior course should be of such an elementary nature as could be assimilated by the owners of kampongs and small estates, that the instruction should be conducted in the vernacular, and that the syllabus should be covered if possible in a period of one year. The proposed amendments appeared at first to be open to objection in that students of non-Malay origin are unable to read and write the Malay language; but, on examination, this difficulty was found to be not insuperable, for such students are perfectly capable of speaking Malay and therefore of understanding both lectures and practical work, while any written matter could be undertaken simultaneously in both English and Malay. On the whole, the One Year Course appears to have everything in its favour, not only from the point of view of the private student but also in relation to the training of certain minor Government officials such as padi inspectors and overseers on agricultural demonstration stations. The proposed substitution of a One Year Course for the Two Years Course has not, at the time of writing, been formally approved by Government; but an appropriate syllabus has been drawn up in readiness, comprising such subjects as Nature Study, Animal Study, Field Crops and Elementary Principles of Agriculture; while there would in all probability be time also for some carpentry and metal-work, arithmetic and office routine, to say nothing of a series of lectures on the agricultural geography of Malaya and neighbouring countries—a subject on which even advanced students in Malaya appear to be lamentably ill-informed.

In fact, the proposed syllabus partakes essentially of the nature of the Farm School courses which have already proved successful in Java, Ceylon, Mauritius and elsewhere. In relation to such Farm Schools, however, it should be observed that they should be small and that one such school is unlikely to prove sufficient for a country of the size of Malaya. The desirability of providing at no distant date a number of such schools at various centres in the Peninsula is clearly indicated, and a project for expansion in this direction is already under consideration. It is felt that, once the course at Serdang has had the opportunity of proving its value and popularity, similar schools should be established in Perak, Negri Sembilan and Pahang.

The proposed Farm School course should not be confused with the Three Years Course at the School of Agriculture, which will aim at providing a more profound training and is in consequence applicable only to more advanced students. A course of this nature involves a certain amount of instruction in the pure sciences, such as Chemistry, Physics and Botany, upon which the whole of agricultural science depends.

The value of pure science as a foundation to agriculture, generally neglected in the past, is rapidly being appreciated now-a-days in the majority of agricultural countries, both temperate and tropical. But the subject matter cannot be taught in such an unscientific language as Malay, and the only convenient medium for instruction is therefore English. The present day student in this country, even when he has negotiated the Cambridge Junior Local Examination, is almost entirely ignorant of science in any shape or form, and it will take some years before the laboratories which have been erected in certain local secondary schools during the past three years can turn out students with even an elementary understanding of the fundamental principles of Chemistry and Biology. Meanwhile, the School of Agriculture itself must supply the deficiency.

For the more advanced students who are expected to avail themselves of the major course, the proposed syllabus may be roughly divided into three periods: Science, Agricultural Science, and Scientific Agriculture. Examined in detail, this means that the first year should be devoted to Chemistry and Physics, Botany, Zoology and Mathematics, so far as the class-room is concerned; the second year would introduce subjects such as Mycology and Entomology, Plant Breeding and Propagation; while the third year would be free for detailed work on tropical crops, and for such subjects as Agricultural Economics and Law, Animal Husbandry and Veterinary Science, Estate Sanitation and Hygiene. Throughout his three years at the School, each student would be required to maintain his own cultivation plots, on which quick-growing crops like vegetables could be grown under more or less the same conditions as obtain in school gardens; while practical instruction in carpentry and metal-work could be included as suggested for the minor course.

The above rapidly sketched syllabus represents the existing proposals of the Advisory Committee in relation to the Three Years Course at the School, and, in conjunction with the minor course, should provide a sound education not only for Asiatic officers of the Department of Agriculture but also for a large number of private students with agricultural interests in this country. Success will naturally depend upon the provision of a capable and adequate staff, working under the guidance of an efficient administration. Granted these conditions, it would appear not unlikely that Malaya will possess an Agricultural School second to none in the British Tropics, and that considerable expansion will prove desirable at no distant date.

REJUVENATION AND REPLANTING OF RUBBER AREAS.

BY

B. J. Eaton,

Acting Director, Rubber Research Institute of Malaya.

The terms "rejuvenation" and "replanting" are both frequently used to indicate the problem of replacement of old low yielding rubber trees with material of superior yielding qualities. The word "rejuvenation" is more strictly applicable to the improvement of existing areas in which a certain amount of supplying in addition to treatment of soil is to be carried out. The term "replanting" should be applied if old trees are to be completely removed and the area is to be replanted with new seedling or buddings.

In view of the high yielding material now available in the form of budded rubber trees, the problem of replanting of old areas of rubber is being seriously considered by companies who have no available jungle reserves.

The important factors in this problem are three:—

(1) The probability of yields from "proved clones" amounting to 1,000 to 1,500 lbs. per acre.

(2) Poor yields from old areas due to soil erosion, soil impoverishment from previous crops, or to bad tapping causing poor bark renewal.

(3) The incidence of root disease in old rubber, which is considered by most plant pathologists to be the limiting factor in the life of a considerable proportion of the oldest rubber.

It is not proposed in this article to consider the problem of supplying, since in old rubber the supplying of small patches on which the old trees have been removed on account of disease or for other reasons cannot be considered satisfactory on account of the shade and root competition of the surrounding old trees.

There appears little doubt that the most satisfactory method is the complete removal of the old trees, so that a block can be entirely replanted with the high yielding material available.

Treatment of Old Trees.

A programme must be carefully laid down, so that all the possible latex can be obtained from the trees, on the areas to be planted, before these trees are removed.

No hard and fast rules can be laid down, since the tapping system, in respect of the number of cuts and height of tapping will depend on the bark available and on the period which will elapse before it is decided to remove the trees.

Methods such as the scraping of the bark to induce a greater flow of latex over a short period will be found useful. In some cases, by intensive tapping, it is possible to obtain the previous annual crop within a period of three or four months.

Removal of Old Trees.

The cost of removal of the old trees will depend on a number of factors—(1) the size of the tree, (2) the method of removal, by hand labour or mechanical stumpers, (3) the possibility of sale of the wood from the old trees, (4) the conversion of the old wood into charcoal for sale.

These factors will depend entirely on local circumstances. On an area of 200 acres in Malacca, visited by the writer a few years ago, the felling, clearing and planting of the new material cost practically nothing, since the Manager was able to arrange a contract for the conversion of all the old wood into charcoal.

On the site on which the charcoal pits were constructed, the subsequent growth of the rubber was excellent and stated to be in advance of the general growth of the trees on the rest of the area. An addition of superphosphates was found to be of benefit.

The chief disadvantage of the removal of all the wood is that valuable fertilising material, especially potash, is removed from the area. In any case, if the wood is burnt on the spot, it should be stacked and burnt in big heaps, preferably if possible, on paths, roads or land not suitable for replanting since the burning of the wood causes soil sterilisation and further destruction of valuable humus. The ash, however, which contains valuable potash, should be distributed over the land.

Cultivation.

On areas on which the trees have been removed on account of root disease, the complete removal of all laterals and stumps is very desirable, while the soil should be cultivated to a depth of 1 to 1½ feet. On areas which have suffered from soil erosion or soil impoverishment, it is extremely doubtful whether immediate replanting with high yielding material is advisable. In such cases, a leguminous cover crop should be established by the addition, if necessary, of artificial fertilizers—especially potash and phosphates. There is little doubt that one of the most suitable plants for this purpose is the Giant-Mimosa—*Mimosa invisa*. Although there is considerable prejudice against this plant in Malaya, the writer has seen excellent rejuvenation and regeneration of poor soils with this cover plant both in Java and Sumatra. In order, however, to keep the cover in check, periodic rolling is advisable to flatten the growth. In Sumatra, the coolies are provided with boots and carry out this operation successfully with an old oil drum. This applies, of course, only to flat or very gently undulating land.

It is also certain that, in most old areas in Malaya, a manuring programme from the commencement is desirable, and on this point the advice of the Rubber Research Institute should be sought.

Previous to planting, unless there is a special reason for hastening this, the area according to its configuration should be bunded or terraced.

On even absolutely flat land, when the soil is of loose texture (this does not apply to the heavy coastal alluvial clay soils) bunding should be adopted in order to conserve rainfall and to prevent soil movement. In Sumatra, at the present time, the most intensive bunding is being adopted on most rubber estates. The material from the bunds is derived from the digging of pits. These pits are similar to the ordinary silt pits, but are dug only to provide soil for the bunds.

Where it can be established, it would appear that the most satisfactory "permanent" cover crop at present is *Centrosema pubescens*. This should be established as early as possible on the bunds in order to protect them from erosion.

The problem of cover crops *versus* clean weeding on areas to which fertilisers are applied is still a debatable point owing to the competition for the fertilisers of the cover crop with the rubber plant. In the long run, however, any fertiliser applied in the presence of a cover crop will become available for the rubber tree.

In any case, the permanent cover crop should be planted in strips between the rows. Small quantities of fertiliser can then be used in the planting holes by thoroughly mixing the fertiliser with the soil used for filling the holes, so that the young rubber plant will receive an early stimulus. If applied in this manner, the rubber plant will be able to absorb the fertiliser.

The establishment of a cover crop is of great importance in providing additional humus and also in maintaining the soil at a lower temperature.

On areas on which root disease has been prevalent, it is also advisable to dig in 1½—2 tons of lime per acre when the cultivation of the soil is carried out.

Planting Material and Spacing.

At this date, the only suitable material for replanting areas which have suffered from soil impoverishment, due to erosion or other causes, and to root disease, is buddings of "proved" clones. A few years ago the close planting of seedlings or stumps from ordinary seed or from seed from a high yielding area, with subsequent thinning out, based on early test tapping, would have been recommended. Even more recently, the planting of alternate buddings and plants from so called "selected" seed would have been advised.

At the present stage of our knowledge, however, mixed buddings only are recommended, using material from the best "proved" clones, that is, budwood obtained from clones which have the highest yield records over the longest

tapping period, provided that no undesirable characters have developed in such clones.

Possibly at a later stage, pure plantings of buddings of one clone on definite areas may be recommended for replanting programmes.

At the present time there are about six clones available which have a fairly long tapping record and which have not developed any undesirable characteristics. Other promising clones with a shorter tapping record are also available. On account of our knowledge of the yielding capacity, growth and bark renewal of buddings, it is not recommended at this date to replant with "selected" seed so that a much smaller number of buddings per acre can be planted than in the case of "selected" seed, since the subsequent thinning out of the replanted area will be on a low scale.

It is not advised to mix too many clones,—a selection of six of the best clones recommended is advised as a maximum. A spacing of 20 ft. x 20 ft. is suitable.

Cost of Replanting.

No definite figures can be given to cover all cases, owing to the number of factors involved. It should, however, be possible on most areas to replant at a cost of £25/- per acre and to bring the area into bearing for £35/- to £40/- per acre. It is not a difficult problem therefore to estimate the period during which the loss of yields from the old area will be covered by the yield from the new planting. The rate at which replanting is carried out will depend on the material available for replanting, i.e. the establishment of nurseries for stock and the establishment of multiplication nurseries for the supply of budwood. It would be uneconomic to purchase budwood at high prices for planting the areas. It is preferable to establish multiplication nurseries for the supply of such budwood. On this account, a scheme should be worked out in detail before being put into operation so that the necessary amount of budwood is available for the area to be replanted in any year. Advice and information on this can be obtained from the Rubber Research Institute.

General.

At the present time, large areas both in Malaya and in the Netherlands East Indies are being planted with buddings which are expected to yield in the 8th to 10th year at the rate of about 1,000 lbs. per acre. It will be impossible for many of the old areas at present in existence to compete with such yields. The old areas will also progressively decrease in production, due to disease and other factors while the new areas, planted under modern conditions with high yielding material will progressively increase in production. On all estates, therefore, on which the trees are definitely known to be a wasting asset, the problem of replanting must be considered. Even where a company has reserve

jungle on which to plant high yielding material, it is advisable to adopt a progressive replanting scheme, since with proper treatment the replanted areas will soon more than repay for the treatment adopted. Only on a few areas, on which the surface soil has practically disappeared due to erosion, is a replanting scheme not advised. The only possible treatment for such areas is a rejuvenation or reconditioning of the soil by the planting of a cover crop such as *Mimosa invisa*. It is not possible to state definitely how long it will be necessary to allow such areas to remain under a cover crop before they will be of value for replanting.

We are only concerned here, however, with the replanting of areas which are becoming uneconomic on account of the following factors:—

1. Early methods of planting without selection of planting material.
2. Late thinning out.
3. Bad methods of tapping and poor bark renewal.
4. Root diseases due to lack of suitable treatment in the early stages of growth of the plant.

The planting of high yielding material combined with modern methods of soil conservation, the cultivation of a suitable cover crop and a system of manuring, renders the replanting of such areas an economic and commercially practicable proposition.

SELECTED ARTICLES.

RUBBER, COFFEE AND TEA MARKETS IN 1929.*

Rubber.

The rubber plantation industry has passed through one of the most critical years in its history, due to the uncertainties and unknown factors brought about by the aftermath of a restriction scheme lasting six years, which came to an end on November 1 a year ago. The average daily price for this year will not be better than 10d. per pound, which compares with 10¾d. for the whole of last year. The highest price during the year for spot delivery was 1s. 1¼d. in February, a sharp rise due to speculative operations taking place, but "bear" sales and adverse statistical features caused liquidations of forward positions from time to time, and the lowest level since April, 1928, of 7½d. was reached in November.

Production, in terms of shipments from the East, have been exceptionally heavy and in excess of all market estimates owing to extremely favourable climatic conditions prolonging the natural "flush," the result of the enforced resting of trees during the restriction period. In the light of exports for the eleven months to date, it is probable that production from all sources for 1929 will reach a record of 860,000 tons.

A satisfactory feature offsetting the increase in production has been the expansion in consumption from all consuming centres. Demand from America, the largest buyer, has shown an increase of 7½ per cent compared with the year before, while world consumption outside America has grown by over 50 per cent. It would appear that the total consumption for 1929 will be over 800,000 tons.

A factor depressing the price this year has been the large forward contracts entered into by many estates at prices round 8½d. per pound, London terms, with optional Continental port clauses and for New York. No forward commitments of importance have been made for next year, which is a satisfactory feature from the market point of view.

Stock position in all consuming centres increased during the year, as the large accumulations in the East, which were previously unexportable, found their way into stocks, and the larger monthly shipments on the resumption of unrestricted output by estates have been higher than the market could cope with.....The outcome of low prices has been more scientific and economical working of estates, making for lower costs all round, so that many companies are able to show fair profits with the commodity at anything over 8d. per pound. It is possible to take a more favourable outlook for next year, allowing for consumption being maintained, as the absence of forward contracts makes for

* The following reviews on rubber, coffee and tea are reprinted from "The Commercial," Vol. XIX, No. 497, December 26, 1929. Published by the "Manchester Guardian."

a free market, and reduced yields are to be expected from estates after the first "flush," due to resting of the trees in all the countries of production.

Coffee.

In common with a number of other tropical or subtropical commodities, there has in recent years been a large overproduction of coffee, but in this case the difficulties which usually follow overproduction have been rendered worse by the taxation which confronts the article at almost every point. In Brazil, where millions of British capital are invested, the Coffee Institute has tried to limit shipments in order to stabilise the price, but these attempts have broken down. Consuming markets have been overwhelmed with supplies, and prices have tumbled everywhere.

Brazil supplies most of the world's coffee, and her 1929-30 crop touches 17 million bags. One authority forecasts that the 1930-31 crop will be larger still. It is stated, however, that the Sao Paulo Government is now engaged on a comprehensive scheme to deal with the present situation with a view to the gradual liquidation of the existing surplus stocks, and it appears likely that this scheme, when published, will involve the calling for further capital investment. There is every likelihood, however, that ultimately the position will right itself by the reduction of working costs to somewhere below market values. One or two seasons of low production—and these things come in cycles—would make a world of difference to the financial position of the planting companies.

During the present year coffee production has made some progress in British Africa notably in Kenya, but on account of low world prices the enterprise has not yielded the hoped for results.

Tea.

The close of the year finds the tea industry in a difficult position, brought about by overproduction and by the fall in the re-export trade. On the production side we had a carryover of stock from 1928 amounting to 30,000,000 lb., and in the course of the present year there has been an increase in receipts of 55,000,000 lb., so that in all we have a surplus of 85,000,000 lb. to deal with. What is more, Southern India, Sumatra and Java have large planting programmes in hand, and if these are proceeded with there is every prospect of still larger supplies.

In this year's Budget the import duty of 4d. per pound on tea was swept away, and the expectation that this event would lead to a large increase in consumption was only partially fulfilled. Burdened with stocks, the Mincing Lane market found itself unable to maintain the export trade on the basis of 1928, and much tea of medium quality was sold at about 6d. per pound. At the rates ruling in May and June the business was unprofitable to the gardens

and many lots were withdrawn. This poorness of trade was, however, confined to the medium and low descriptions, for there has been a strong demand for teas of the finest grades, which always fetch good prices.

In the hope of remedying the stock position, proposals have lately been made to restrict production. Details of this scheme were given in "The Commercial" of December 12. It is suggested that for 1930 there should be a reduction of 10 per cent based on the figures of 1928.

On the marketing side 1929 has had a rosier hue. Leaf has been cheap, and the big blending and distributing houses have taken the opportunity to recoup themselves for some of the lean years previously experienced. The re-export trade has been poor this year in comparison with 1928, but as a result of an intensive publicity campaign which is now being inaugurated in a number of countries it is expected that better things will be witnessed next year. Perhaps the most hopeful quarter is Russia, which before the war was our best customer for tea. The resumption of diplomatic relations between that country and Great Britain ought to be very helpful to the trade, and it is satisfactory to know that negotiations are now going on between the various tea producing countries by the adoption of which large supplies will be made available to Russia on long-term credits.

THE IMPROVEMENT OF RICE CULTIVATION IN MALAYA, INDO-CHINA AND JAVA.*

The following is a Résumé of an article on the improvement of rice cultivation by Mr. L. Lord, M.A., Economic Botanist of the Ceylon Department of Agriculture.

During March and April, 1929, the Economic Botanist of the Department of Agriculture, Ceylon, visited Malaya, Indo-China and Java in order to study the methods adopted in these countries for the improvement of rice production. The main questions on which information was sought were:—

(a) The use and usefulness of pedigree seed.

(b) The organization of seed supply.

(c) Manuring and cultural practices.

(d) The technique of selection and hybridization.

A. Malaya.

It is pointed out that Malaya fails to grow enough rice for the requirements of the population and that a large quantity has to be imported. Efforts which are being made to increase yields are described under two heads: first and chiefly, the selection or breeding of improved seed and its dissemination among cultivators; and secondly, the demonstration and encouragement of manuring. The work of seed-selection and hybridizing is carried out by the Division of Economic Botany in the Department of Agriculture, S.S. & F.M.S. There are two rice selection stations, the chief of which, and the one where almost all of the selection work has been done is at Titi Serong in Perak and has an area of 21 acres. The other is in Malacca and is 26 acres in extent. In addition, there are test and multiplication stations in other rice-growing areas of the Peninsula. The average size of these stations is 4—5 acres.

The pedigree selections already made and tested at Titi Serong are again tried at the test stations for a number of years, after which suitable selections are distributed to cultivators.

The methods of pure-line selection employed differ only in detail from those adopted in Ceylon. For example, in Malaya, lines are selected on a basis of yield per plant, rather than yield per panicle as in Ceylon. The question of the comparative utility of the two methods is being investigated, as in Ceylon, profuse tillering is not always desired. Bagging is not resorted to for maintaining purity of lines, but this is ensured by growing three lines of plants of each selection and using the seed of the middle line only for continuing the selection. Seed of the outside lines is used for multiplication plots. Pedigree

* The Tropical Agriculturist, Vol. LXXIII, No. 6. December 1929.

selections are tested in small plots replicated sufficiently to detect 10% differences in yield. In the Krian district the standard error of a single plot of 1/40 acre is 7.6% and if 1/20 acre, 6.6%. Test plots are always situated well away from the bunds. The random arrangement of plots with replication in compact blocks is not used in Malaya; nevertheless the standard errors are very similar to those in Ceylon.

Crosses are now being made of different pedigree selections at Titi Serong.

Manuring experiments are being conducted at five stations, but the results have not yet been published. It is considered, however, that manuring as a means of improving the yield of rice has great possibilities.

B. Indo-China.

The position of the rice industry in Indo-China differs radically from that of Ceylon and Malaya in that it is a large rice-exporting country, in fact, its exports are only exceeded in quantity by Burma. In view of this important point, the problem of the improvement of yield per acre, which is the chief object of the work in Ceylon is, in Indo-China, considered of less importance than the quality of the grain. As most of the rice is exported, evenness of grain is wanted, not only to reduce loss by breakage in milling, but also to ensure getting the best market price.

The produce of the cultivators' fields is frequently a mixture of varieties varying in size of grain so that it is difficult to get large quantities of padi reputedly of one type. This difficulty is increased by the habit of Chinese buyers of mixing different lots before sending them to the mills.

Unless the crop from selected seed is heavier, or unless it commands a premium on account of its evenness, there is no incentive to the cultivator to grow the seed.

Whilst pedigree breeding and manuring are receiving attention, the mechanical selection of seed is another line of improvement which is foreign to Ceylon. As the cultivators' seed is invariably a mixture of types differing in size of grain, it is put through a mechanical grader which separates the main types. The type desired is retained and distributed to cultivators. This seed is not, of course, a pure line seed as it may consist of a number of varieties, but in size of grain it is homogeneous. It is not thought that mechanical seed-selection can be of any use in Ceylon, because pedigree seed will fulfil all requirements.

Crosses between a Carolina rice and a local pure line have been made. Some of these are promising and certain of them, which were breeding true, have been selected for multiplication and testing.

The statement is made that it is comparatively easy to produce a satisfactory pedigree selection, but it is extremely difficult to ensure that seed of the selection gets into the hands of the cultivators periodically and in sufficient quantities.

It is a problem whose detailed solution must vary in different countries, and India must be looked to for guidance on this point.

C. Java.

The difference in the rice industries of Ceylon and Java is seen in the following figures:—

Whereas Ceylon in 1924-27 had an average importation of 84.1 k.g. per capita, that for Java in 1922-25 was 7 k.g. only. In 1926 and 1927 imports into Java fell with the decline in exports of high quality rice. Consumption, per capita, in the two countries did not differ greatly.

The 8,256,000 acres of rice land in Java yielded an average of over 1,300 lbs. of padi per acre. In Ceylon, the average area of 792,000 acres for the years 1921-25 is shown as having an average production of 634 lbs. per acre. The Ceylon figures, however, are admittedly open to a large error for various reasons.

In Java, not only is the soil fertile, but the irrigation systems are excellent. The soil is also suitable for dry crops, and on most land, rice is rotated with maize, soya-beans and ground-nuts as well as with sugar-cane. This rotation of crops is certainly responsible for increasing the yield of rice. On the much less friable padi soils of Ceylon the practice of a rotation is difficult, or impossible.

The pure-line selection of rice in Java has not yet been particularly successful and several reasons are adduced to account for this; for example, it was found that seed selected under the particular soil and climatic conditions of the chief station at Buitenzorg behaved differently in other areas, and that cross-pollination was by no means negligible.

Three selection stations on the main soil types are to be established, whilst a fourth, on a laterite soil of volcanic origin, will be formed at Buitenzorg. The selected seed after being thoroughly tested will be multiplied in about 60 small farms of about 7-9 acres each. After being tested in these small areas it will be tested and multiplied again in larger areas known as 'multiplication fields' before being distributed to cultivators.

In the actual work of selection, bagging will be adopted to ensure the purity of the lines. The importance of carrying out selection work on the particular soil type for which seed is desired is stressed.

The amount of seed at present distributed is negligible, and there is no co-operative or other agency for such distribution.

In regard to the manuring of rice, it has been found that phosphatic fertilizers on many soils give large increases in yield. On some soils nitrogen has also proved of value. In spite of the increases in yield which can be obtained, the consumption of artificial fertilizers is small, due to the great want of money of the native farmer for whom an adequate form of agricultural credit is essential.

Sugar is grown on a large scale on rice land rented from native cultivators for one year in three or four.

In an editorial in the same number of the publication the following paragraph occurs. As the remarks made apply equally well to Malaya they may be usefully quoted here:—

> "The wide use of pedigree seed alone will never enable Ceylon to grow sufficient rice for her needs. Pedigree seed will help, but so will the use of manures, and, as was suggested in this journal for August, manuring has the promise of being the best method of rapidly increasing yields. But even if the correct manuring practice is known and the best pedigree seed is available, the problem of sufficiently increasing production is by no means solved. There are, for example, the following factors to be considered among others: the supply of credit for purchasing seed and manures, and the efficient distribution of these. There is the factor of malaria, especially where new land is to be brought under cultivation, and there is the very important factor of water. Without an adequate supply of water, good seed and manures are useless, and in many districts dependence solely on rainfall makes rice cultivation pitiably precarious."

W.N.S.

REVIEWS.

Sisal.
Production and Preparation.

Edited and brought up-to-date by H. Hamel Smith.
(London. John Bale, Sons and Danielsson Ltd.)

This book consists mainly of a number of reports and memoranda, concerning the production of sisal hemp, gathered together from various countries. In addition, chapters on alcohol from sisal refuse, Colombian Pita Fibre, and an account of various machines and methods employed in the preparation of the fibre, are included. The book is divided into two parts. Part I refers in particular to Production while Part II deals with Preparation.

The first two chapters are composed of published accounts of attempts to establish sisal industries in India and Queensland. These reports, issued in 1906 and 1910 respectively, though containing a considerable amount of information, are of little use to the practical planter. Chapters follow on the cultivation of this crop, commercially and otherwise, in Ceylon, Kenya and East Africa, Malaya, Cocos Islands, Mexico, Philippine Islands, Java and Sumatra, and Cuba.

No attempt is made to apportion the amount of text in these chapters with regard to the relative importance of the sisal industry in the countries mentioned. On the contrary, Tanganyika, an important sisal producing country receives two pages only while Queensland, where the cultivation of sisal is of small account, is allotted 86 pages. The chapter on Malaya consists of extracts from a report published in the Malayan Agricultural Journal, November, 1924, Vol. XII, No. 11.

The account of sisal production in Java and Sumatra conveys little information of value. This, however, is not more than might be expected as definite data regarding the activities of the larger plantations in the Netherlands East Indies is not readily available. It is known, however, that sisal from Java is of first class quality and commands high prices.

The preparation of the fibre as undertaken in East Africa is described in some detail and conveys a useful account of this operation. This is followed by a series of descriptions by several well-known firms of their machinery, and the factory methods employed in sisal producing countries. These accounts are of considerable assistance but leave the reader in some doubt as to the relative values of the several types of machines described.

The book as a whole contains much useful information but owing to the way it is presented, the reader will have some difficulty in piecing together an account of the industry from planting to marketing.

The book contains forty-seven illustrations, which are clearly reproduced and give a good idea of sisal cultivation and preparation in its various phases. A bibliography and an adequate index are provided.

J.N.M.

Begemann, H. Over Schildluizen van de Koffie (Scale Insects of Coffee) Archief voor de Koffie Cultuur in Nederlandsche-Indie; Mededeelingen van het Proefstation Malang. No. 71, December, 1929, pp. 113-166.

Three of the most important Mealy bugs and two important scale insects which attack various parts of the coffee plant are dealt with. The mealy bugs are *Pseudococcus citri*? Risso. (Witteekoffieluis or white mealy bug of coffee). *Ferrisia virgatus* Ckll. (Lamtorosluis or Mealy bug of *Leucaena glauca*), *Pseudococcus citri*, Risso, (Witte wortelluis or white root-mealy bug); *Coccus viridis*, Green. (Groene koffieluis or Green coffee scale) and *Saissetia haemisphericum*, Targ. (Bruine luis or brown scale).

Concerning *P. citri*? Risso. the author states that this species is also named the "Castilloa luis" or "Cacao luis" to distinguish it from the common "cacao luis" (*P. crotonis*). The white mealy bug which, not only in the Dutch East Indies, but also in other countries, is harmful to coffee, is still considered the same species which is also harmful to Citrus and is described as *P. citri* Risso. This species is now spread over the whole world.

Reference is made to the work of Kirkpatrick in Kenya who has shewn that the coffee mealy bug is not conspecific with the citrus mealy bug but is *P. lilacinus*, Ckll., and moreover the white coffee-mealy bug very seldom migrates to citrus trees even if they grow close to attacked coffee. The numerous predators and parasites of the mealy bugs and scales are fully dealt with. Among those mentioned are Psocidae, Hemerobiidae, Chrysopidae, larvae of the Noctuid moth *Eublemma rubra*, Hamps. and of the Lycaenid butterfly *Spalgis epius*, Walk.

Beetle predators comprise almost exclusively the Coccinellids or "Lady-birds". The most important is a species of Scymnus. The introduction of members of this family from other countries is also discussed.

The Order Diptera, or two winged flies includes some species which are important enemies. A species of Diplosis is considered the most useful. Hymenopterous parasites are represented by various members of the super-family Chalcidodea, one of which is *Leptomastix trilongifasciatus*, Girault. The influence of climatological factors on the increase of mealy bugs, the damage caused by them and control measures are discussed at length.

Control methods are grouped under four headings—cultural, chemical, mechanical and biological. Cultural methods of control comprise the high

pruning of shade trees, hygiene of the trees, and the removal of faded and dried remains of flowers.

Three types of chemical control are suggested. They are,—direct chemical control, indirect control by killing the ants which pasture mealy bugs, and the combination of both methods.

Mechanical control includes the cleaning off the mealy bugs, strewing dry sand on the berries and pruning and burning. The object of the strewing of dry sand is that it adheres to the viscid excrement of the mealy bugs and kills them. The pruning and burning method is directed chiefly against the bugs on shade trees and fences before they have migrated to the coffee.

The section "biological control" deals at length with the practicability of combating mealy bugs by the introduction of predators. Taking into account the comparatively low cost of such undertakings, the author is of the opinion that this is an economical method of control.

He adds that, while awaiting the results of further research, the surest method is a systematic control of ants to prevent their spreading mealy bugs.

The report is illustrated by many very excellent photographs.

N.C.E.M.

Burma Agricultural Reports

for the nine months ending 31st March, 1929.

Rangoon. Supdt. Govt. Printing and Stationery, Burma, 1929.

The Burma Government has recently published a number of reports on the activities of the Burma Department of Agriculture, for the year ending on the 31st March, 1929, covering nine months. In addition to the reports of the Agricultural Engineer, Agricultural Chemist, Mycologist, Entomologist, Economic Botanist, the Agricultural College and Research Institute, and that on Sericultural Operations, detailed reports are presented of twelve agricultural stations. Three of these stations are of considerable area, but the majority range in area from 50 to 150 acres each. The total area of the stations is over 2500 acres. Many are concerned mainly with padi cultivation problems with the object of the improvement of yield and varieties suitable for export.

One of the problems on which exhaustive trials are proceeding is that of manuring padi. The fact that padi is grown in water renders this research extremely difficult, and we have yet to see conclusive results either in the records under review or elsewhere in the East, on which to base a positive policy of manuring. The Burma experiments are designed on the use of artificial fertilisers to decide whether the plant is most responsive to nitrogen, phosphates, potash or lime and conclusions on this would certainly prove a

valuable contribution to the subject of manuring padi. In most of the Burma experiments, negative or inconclusive results have been obtained, although lime and cattle manure applied together gave a notable increase on the poor soil at the Myaungmya Agricultural Station. This rather confirms the results obtained elsewhere, that padi responds to an increase in organic matter in the soil.

Among other crops mentioned in their reports it is noticed that palm oil is making vigorous growth on certain of these stations.

In common with agricultural reports from many countries—and we do not hold ourselves blameless in this respect—these reports make frequent use of vernacular words and of local weights and measures. This is very confusing to the reader who may wish to compare results from different countries. If investigators could agree to a standard of weights and measures, would use botanical terms in addition to local names, and would avoid as far as possible, the use of vernacular words to express agricultural operations, the task of comparing results would be greatly facilitated.

D.H.G.

FROM THE DISTRICTS.

The Weather.

February was a hot dry month, with day temperatures above the normal. It would appear that the North East Monsoon has failed completely. The East Coast has experienced a strong east wind which now shews signs of changing to the south.

Remarks on Crops.

Rubber.—Wintering has been general and rapid owing to the dry weather. Rain is now needed to bring out the new foliage. One favourable aspect of the dry weather has been in the easier control of rubber diseases. Mouldy Rot disease has not been virulent in any district, and control of such cases as have been found has not been very difficult.

There is an increasing tendency amongst Chinese rubber estate owners to rest their trees during the wintering period—a practice which is more general on the large European owned estates. Such action has had a beneficial effect on the incidence of Mouldy Rot disease. Small-holders, however, continue to tap their trees under any conditions.

Padi.—In the important padi area in Krian, prospects are more promising than was at one time thought probable. The areas in Briah, Selinsing and Gunong Semanggol have 10,500 acres planted, leaving 3,500 acres unplanted. Crops in this area will be light. The more important areas in Kuala Kurau, Bagan Tiang and Tanjong Piandang, where the best padi land of Krian is situated, contain nearly 34,000 acres. It is stated that these areas contain a very promising crop and the same applied to the large area in Bagan Serai. The crop, however, is somewhat late and experience indicates that it is more than likely that wet weather will attend the harvesting which is bound to result in loss of garnered grain.

A good crop of padi is likely in the districts of Kuala Kangsar, Upper Perak and the sub-district of Selama. Over a large part of Larut only a light crop can be expected.

Harvesting is in progress in Lower Perak. Rat damage has been serious in some places, but generally, yields are expected to be good.

Province Wellesley contains a considerable area under padi. Harvesting is in progress in most places, but crops are expected to be very light. This is particularly the case in the North and Central districts. Many lessees of padi land have abandoned their crops and absconded knowing that they would be unable to pay the rent due on completion of harvest.

Negri Sembilan reports state that the dry weather has hastened the ripening of padi and harvesting, where not finished, is being actively carried on.

In Malacca, the yields obtained, as anticipated, are up to average.

In West Pahang, crops have been above the very low average. The planted area this season was 11,000 acres, an increase of over 2,600 acres over the previous year.

Coffee.—The recent fall in the price of coffee has severely hit the Chinese growers in the Temerloh district of Pahang.

Fruit.—A moderate crop of langsat, durian, mangosteen and rambutan continued to be harvested in all districts in Pahang.

Notes on Demonstration Stations and Padi Test Plots.

Kuala Kangsar Demonstration Station, Perak.—The old orange trees are bearing a heavy crop, but the fruit, however, is so small that it will probably be unsaleable. Four year old rooted marcots are also fruiting heavily, the fruits in this case being of normal size.

Talang Padi Test Plot, Perak.—At the end of the month, harvesting was still in progress. Work is slow owing to the fact that the harvest coincides with the Mohammedan fasting month. A fair crop has been produced. The pedigree strain, Serendah 741, has done better than usual; a dry season apparently suits it.

Dong Padi Station, Pahang.—The padi crop has been harvested, the yields being the highest since the inception of the Station. The variety, Radin 13, shews remarkably consistant results over some years and these results together with similar ones recorded from field trials by cultivators indicate the suitability of this Krian pure line to the conditions obtaining in the padi areas along the Kuala Lipis road.

Temerloh Padi Station.—Work of preparing the nursery beds is in hand. Varieties Seraup Kechil 36 and 52 will be replaced by Radin 13 and Serendah in this year's trials as it is considered that the Seraup varieties, by virtue of their long maturation period, are unsuited to conditions generally obtaining near the Pahang River.

Pulau Gadong Padi Experimental Station, Malacca.—Yield figures now available shew that some of the selected Nachin Puteh and Padi Siam strains are a distinct advance on the local padi at present grown.

Rats.

Work in the rat campaign in the Krian padi area continued throughout the month, 12,711 rats being killed. In the Province Wellesley campaign, 66,962 rats were accounted for, and 10,000 poison baits distributed.

Rat catching was neglected in Malacca, owing to the havesting of padi and the fasting month. Considering the late start, the control obtained this season was very satisfactory.

DEPARTMENTAL NOTES.

Experimental Work at the Government Plantation, Serdang.

Mr. E. A. Curtler, Assistant Agriculturist, delivered a lecture on the above subject to the Taiping Branch of the Incorporated Society of Planters on the 8th February, 1930.

The lecturer pointed out that the old criticism that the Department of Agriculture confined its attention too much to one crop could no longer apply, as if such criticism was even justified in the past, it was certainly rectified when the Serdang Plantation was opened in 1920. Since then, the Plantation has developed steadily until at the present time 725 acres are opened and planted with a comprehensive collection of economic plants. Owing to the short time at his disposal, Mr. Curtler confined his remarks to but a few of the crops upon which considerable investigations have been carried out at this station. Foremost amongst such crops are oil palms, tea, coffee, sisal hemp, tapioca, tuba root, gambier, fruits and chaulmoogra oil; and in addition, live stock.

Dealing with oil palms, the meeting was informed of the nature of the experimental work on this crop, its objects, and the results obtained to date. Experiments on oil palms were concerned with the effects on the palm and on the crop resulting from artificial pollination under different conditions; on pruning; interplanting with other crops; yield under varying conditions; and factory problems.

The tea work was commenced in 1925. It has comprised a comprehensive series of variety trials, work on planting distances, and more lately, on the preparation of tea.

Coffee experiments have included variety tests, pruning experiments and the effect of various cover crops.

Very important work has been carried out on sisal hemp. Space forbids any detailed account in this place, but the reader is invited to consult back files of this journal for information on the subject. Mr. Curtler stated that small consignments of the fibre prepared at Serdang had been sent to London and had received very favourable reports from manufacturers.

Of the many burning questions of tropical agriculture, that of exhaustion of the soil as a result of tapioca cultivation is receiving attention at the Government Plantation. The effect of tapioca on the soil, and methods of keeping up the fertility of the land are the main lines of investigation.

Three breeds of cattle are represented on the Stock Farm. Work on pig breeding has also been commenced. The main idea on the farm is to use the herd of cattle as a foundation to build up a type of cow suitable for milk production in the lowlands of Malaya, at the same time keeping in view the possibility of utilising the old animals and poor type bulls for beef and the latter for draught purposes. It is hoped that it will also be possible to grade

up the local milch cattle by distributing throughout the country both Friesland and Montgomery bulls from good milking strains. Questions of food and feedings are also being investigated in all their aspects.

It is hoped that the lecture will be published in "The Planter," the official organ of the Incorporated Society of Planters.

Leave.

Mr. F. W. South, Chief Agricultural Field Officer, returned from leave of absence on 9th February, 1930.

Mr. B. Bunting, Agriculturist, returned from leave of absence on 20th February, 1930.

Mr. J. W. Jolly, Agricultural Field Officer, returned from leave of absence on 14th February, 1930.

MARKET PRICES.

February, 1930.

Rubber.—The average London price for rubber for February, 1930, was 7.9 pence per lb., being a rise of .6 pence over the corresponding figure for January, 1930. The highest price quoted was 8¼d., while the lowest quotation was 7 7/16d. The average Singapore price was 26.25 cents, against 24.6 cents in January; the highest price being 27⅛ cents and the lowest 24½ cents per lb.

Copra.—Singapore prices for copra have fallen about ten cents per picul during the month. For the first three weeks of February, the average prices have been $8.86 F.M., and $9.31 S.D. per picul of 133⅓ lbs. The Singapore Chamber of Commerce reports transactions amounting to 3995 tons for the period 20th January to 22nd February.

Coconuts.—$3 per 100 in Singapore.

Gambier.—For the period 20th January—22nd February, 1930, the average Singapore price was $8.96 Bale and $15.50 Cube per picul, 97 tons being recorded by the Singapore Chamber of Commerce.

Nutmegs.—Singapore prices have fallen considerably, the average prices for the month being:—for 110 per lb. $43.20 per picul, 80 per lb. $44.80 per picul.

Pepper.—A sharp rise in prices is recorded in Singapore, the improvement in black pepper being from $43 to $50½ per picul, sales amounting to 169 tons; White Sarawak rising from $64 to $75 per picul, 179 tons being sold. The average prices for the period 20-1-30—22-2-30 were $45.81 for black, and $69.25 for White Sarawak.

Rice.—Siam fell from $415 to $340 per Coyan, Saigon White $240—$260; Rangoon White $252—$226, the average prices being $384.60, $253.80, $239.60 per Coyan respectively.

Sago.—Singapore prices—Pearl, fair $7.50—$7.25, average price $7.20; 125 tons: Flour $4.25—$4.15, average $4.20 per picul, 852 tons being recorded.

Tapioca.—Prices in Singapore well maintained. Flake, small fair improved from $5.50 to slightly over $6, average $5.84 per picul, 774 tons; Pearl, fair, steady around $8, average $7.95 per picul, 29 tons sold.

Pineapples.—$10 per 100 in Singapore.

Bananas.—$4 per 100 in Singapore.

The above market prices are based on the daily cabled London quotations for rubber and on the Singapore Chamber of Commerce Market Reports covering the period 20th January, 1930, to 22nd February, 1930, and from other local sources.

London quotations for other products than rubber will be discontinued owing to the inevitable delay in receiving such reports.

MALAYA RUBBER STATISTICS

STOCKS OF RUBBER HELD BY DEALERS AND ESTATES OF 100 ACRES AND OVER, TOGETHER WITH THE DECLARED PRODUCTION OF THE SAME ESTATES, IMPORT AND EXPORT FIGURES, AND ESTIMATED FIGURES OF THE PRODUCTION OF ESTATES OF LESS THAN 100 ACRES, FOR THE MONTH OF JANUARY, 1930, IN DRY TONS.

Territory	Stocks at beginning of month		Production by estates of 100 acres and over		Production by estates of less than 100 acres		Imports				Exports				Stocks end of month		Stocks at ports end of month	
							during the month		during the year 1930		during the month		during the year 1930					
	Dealers	Estates of 100 acres and over	during the month	during the year 1930	during the month	during the year 1930	Foreign	From Malay States	Foreign	From Malay States	Foreign	Local	Foreign	Local	Dealers	Estates of 100 acres and over	Port Authorities	Private lighters
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
MALAY STATES																		
Federated Malay States	10,501	16,222	13,555	13,555	11,572	11,572	Nil	Nil	Nil	Nil	17,272	6,599	17,272	6,599	11,753	16,226	*	*
Johore	2,343	5,616	3,964	3,964	4,580	4,580	Nil	Nil	Nil	Nil	875	7,962	875	7,962	2,172	5,494		
Kedah	445	2,308	2,195	2,195	1,677	1,677	1	Nil	1	Nil	771	3,071	771	3,071	537	2,247		
Perlis	*	*	*	*	*	*	Nil	Nil	Nil	Nil	Nil	26	Nil	26	21	7		
Kelantan							3	Nil	3	Nil	71	639	71	639	*	*		
Trengganu ...							Nil	Nil	Nil	Nil	Nil	192	Nil	192				
STRAITS SETTLEMENTS																		
Malacca	2,246	1,986	1,479	1,479	3,332	3,332	Nil	1,100	Nil	1,100	4,678	Nil	4,678	Nil	2,482	1,904	Nil	Nil
Province Wellesley	161	867	611	611			Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	150	807	Nil	Nil
Dindings	42	155	107	107			Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	47	163	Nil	Nil
Penang	5,182	15	13	13			891	4,051	891	4,051	6,387	Nil	6,387	Nil	4,977	19	913	46
Singapore	27,395	379	274	274			9,595	13,338	9,595	13,338	23,319	Nil	23,319	Nil	27,875	411	1,729	967

ANALYSIS OF COLONY AND FEDERATED MALAY STATES DEALERS' STOCKS AT END OF MONTH, IN DRY TONS.

Class of rubber	Federated Malay States	Singapore	Penang	Province Wellesley, Dindings and Malacca	Gross total
(20)	(21)	(22)	(23)	(24)	(25)
Smoked sheet	8,842	10,828	3,042	1,490	24,202
Crepe	777	14,207	1,343	676	17,003
Unsmoked sheet	842	2,840	592	513	6,079
Scrap and lump	1,292				
Total all Grades ...	11,753	27,875	4,977	2,679	47,284

Notes.—1. Stocks on estates of less than 100 acres are statistically unimportant.

2. The production of estates of less than 100 acres is estimated from the formula: (Column) (6) = (Columns) (12) + (13) + (16) + (17) — (2) — (3) — (4) — (8) — (9).

3. Dealers' Stocks, S.S., are in dry weights quoted by dealers themselves which differ slightly from the estimate of dry weight quoted in the January Dealers' Return already published. The ratio of this reduction on wet rubber in Singapore and Penang, which can be regarded as entirely foreign rubber, is applied to reduce foreign "wet" imports to dry rubber in column 8. This ratio for January, 1930, is 15%.

4. Straits Settlements domestic exports, in the absence of a direct method, may be estimated as the difference between gross imports and gross exports in terms of dry rubber; this for January, 1930, was 5,409 tons.

5. All local exports by Malay States, except 9 tons, were to the Straits Settlements.

* Not ascertained.

SINGAPORE
February 24, 1930.

J. GORDON CARRIE
for Acting Registrar-General of Statistics, S.S. and F.M.S.

Summary of Padi Report for the Month of January, 1930.

State	Locality	Acreage of Padi Land	Acreage planted Current Season	Remarks.
S. S.	Pro: Wellesley ..	39,640	34,220	Age: 3 to 4 months from date of Planting
	Penang ...	4,000	2,842	Scattered areas about 500 Acres not included. Age:—3 to 4½ months from date of planting. Majority harvesting or about to be harvested.
	Malacca ...	35,279	29,734	
	Total:—S.S.	78,919	66,796	
Perak	North ...	83,402	76,362	Prospects are good in the more important area.
	South ...	*	† 2,930	Prospects generally poor.
	Total:—Perak		79,292	
N. Sembilan	Six Districts ...	37,217	31,405	Prospects good.
Pahang	West ...	4,740	5,317	Harvesting : good.
	East ...	*	*	
Selangor	Five Districts ...	25,212	20,632	Prospects moderately good. Majority already harvested.

* Not ascertained.

† 5,750 acres dry padi not included.

SCHOOL OF AGRICULTURE, MALAYA.

His Highness the Sultan of Selangor laid the foundation stone at Serdang, Selangor, on March 19th, 1930.